the OIL AND GAS JOURNAL

DECEMBER 5, 1955

Canadian Gas to Heat California p. 72

Clareton Choice—Flood or Die p. 80

How Good Design Saves on Upkeep p. 103

Tank Foundations for Weak Soils p. 132

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Greetings
* * * from HALLIBURTON

A glance ahead . . . at press time

These trends will make TOMORROW'S NEWS

U. S. refiners are maintaining an average cushion of about 2 octane numbers over requirements of 1955 models, present surveys indicate.

How much of this cushion will fall before the higher compression ratios of 1956 cars remains to be seen. Preliminary tests are under way, but they can't yet show clearly the weighted requirements of equilibrium engines.

One particular model seems to be bidding for the dubious title of the critical car. With a high compression ratio, it has shown a research octane requirement of 100 and over—on clean engines.

Look for important new reservoir-injection programs to be announced after the turn of the year.

In California, the Rocky Mountains, the Permian basin, and along the Gulf Coast significant new projects are in the engineering stage. Engineers predict 25 per cent of U. S. oil production by 1960 will be from fields in which injection projects are operated.

Highway-department prejudice against cracked asphalts for paving purposes is expected to continue.

The hope that some western state might relax its stringent specifications looks like a false one. Refiners have a great competitive story for their straightrun asphalt vs. portland cement for highways. They might also look into the possibilities of cracked asphalts for soil stabilization and as sealants for highway foundations. Cracked asphalts show superior properties for these end uses.

Developers of fluid coke aren't resting, even though the product has found a home in steam generation by utilities.

Work is continuing toward making fluid coke economic for electrode manufacture. But the first non-fuel use may be realized in the Northwest where mining companies may substitute fluid coke for coal coke in ore processing.

Geophysicists are more optimistic about the exploration activity picture because the industry has rebounded from the 1954 slump. Seismic activity in 1955 bids fair to rival the peak year of 1952 when an average of about 650 crews were employed. Geophysical activity should keep pace with the anticipated rise in needed exploratory drilling in the next year or two.

High-pitched screams from gas pipeline regulator valves now have been traced to high-frequency vibration of inner valve. In some cases several hundred horsepower may be dissipated across these valves, causing plenty of noise and sometimes enough heat to melt part of the valve skirt. Manufacturers are solving problem by beefing up inner valve, moving resonate period above 5,000 cycles per second.

the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

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TECHNOLOGY—OPERATION

Reduced Upkeep Cost on Drilling Platforms 103
By D. B. Stauffer

Here is what to do when designing offshore platforms to protect them against corrosion: (1) reduce total surface area, (2) eliminate hard-to-coat areas, and (3) protect the coating and structure against mechanical damage. Humble Oil & Refining Co. author shows lower maintenance costs that go with better design.

Natural Gasoline Plant Flexibility 106
By A. M. L. Kube and R. H. Stone

Phillips Petroleum Co.'s Dumas gasoline plant affords a good example of a dry-gas plant. Average daily gas volume at present is 150 M.M.c.f.d. but it can handle up to 210.

Deeper Drilling With Less Horsepower 108
By R. E. Westling

Use of drill tubing or casing in place of drill pipe can lead to lower capital investment and lower moving and operating costs, says this Gulf Oil Corp. author. Charts and data are given comparing relative horsepower requirements.

New Petrochemical Instrument Applications 110
By R. G. Marvin, W. L. Stuart, G. W. Lunsford, and E. E. Ludwig

Dow Chemical Co. gives its experience with: (1) digital and analog computers, (2) relative flow measurement at high pressure, (3) ratio flow control of two gas streams in a process, (4) use of strain cell for pressure control, (5) control of an absorption refrigeration system, (6) sealed meter-force balance type, and (7) flow measurement of high-pressure gas streams with impeller-type flow-sensing cell.

This Zinc Coating Can Be Applied in Field 114
By D. H. Stormont

A zinc coating that can be sprayed or brushed on as a "cold-galvanized" process shows much promise against corrosion for a variety of oil-field and refinery installations.

Treating Distillates by Electrical Precipitation 116
By R. J. Phillips

Electric precipitation makes distillate treating, with agents such as caustic, water, and acid, more effective.

Control of Fractionating Columns—Differential Refractometer 123
By O. D. Larrison, F. W. Purl and H. H. Harris

The differential refractometer, a simple and versatile instrument, has been used by Phillips Petroleum Co. on several natural-gasoline and petrochemical separations. It has been applied, for example, in superfractionation for large-scale manufacture of gasoline blending components, as in the normal heptane-toluene separation. Another example is the cyclohexane-methylcyclopentane separation. Advantages, sampling system, specific applications are dealt with.

Why Aerated-Mud Drilling? 128
By R. A. Bobo, R. S. Hoch and G. S. Ormsby

Here is more on the use of aerated mud in drilling. Authors discuss equipment, compressor unit, air control, operation, and the peculiarities of the method—in what respects it differs from conventional mud drilling.

Tank Foundations for Weak Soils 132
By J. R. Sellers

Concrete mat with piling, concrete ring with piling, and crushed rock fill—these three foundation designs are used at one terminal. Experience with these three designs is given here.

Nelson Refinery Construction Index 135

Pipeline Patrol 145
By J. D. Kelley

Hydrostatic Testing of Old Pipelines.

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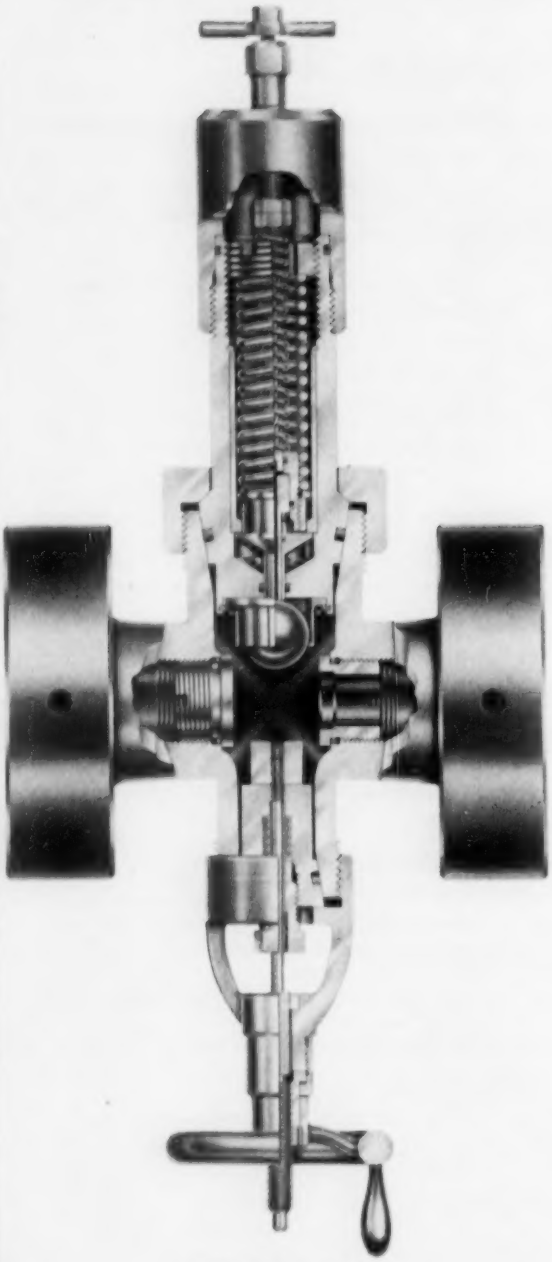

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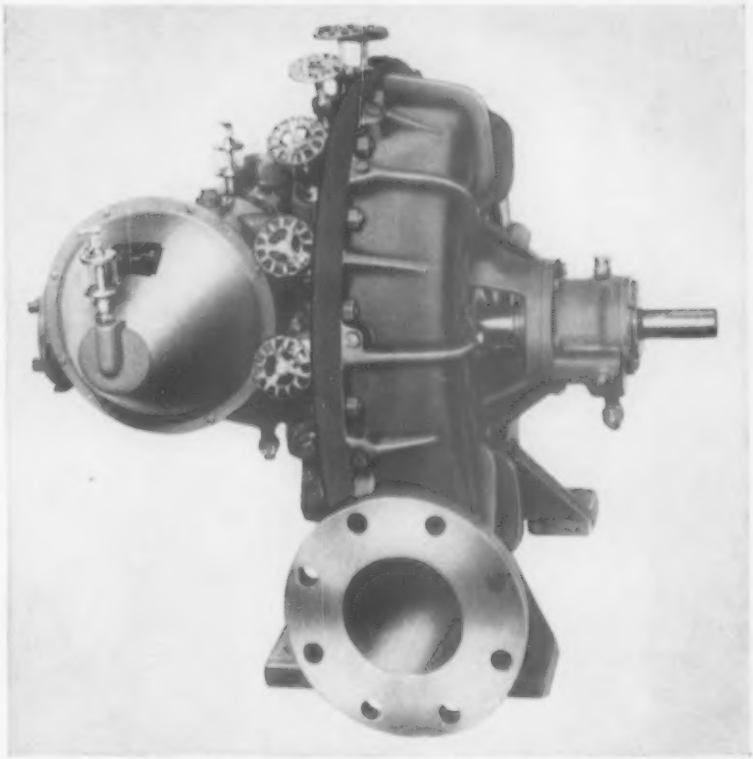

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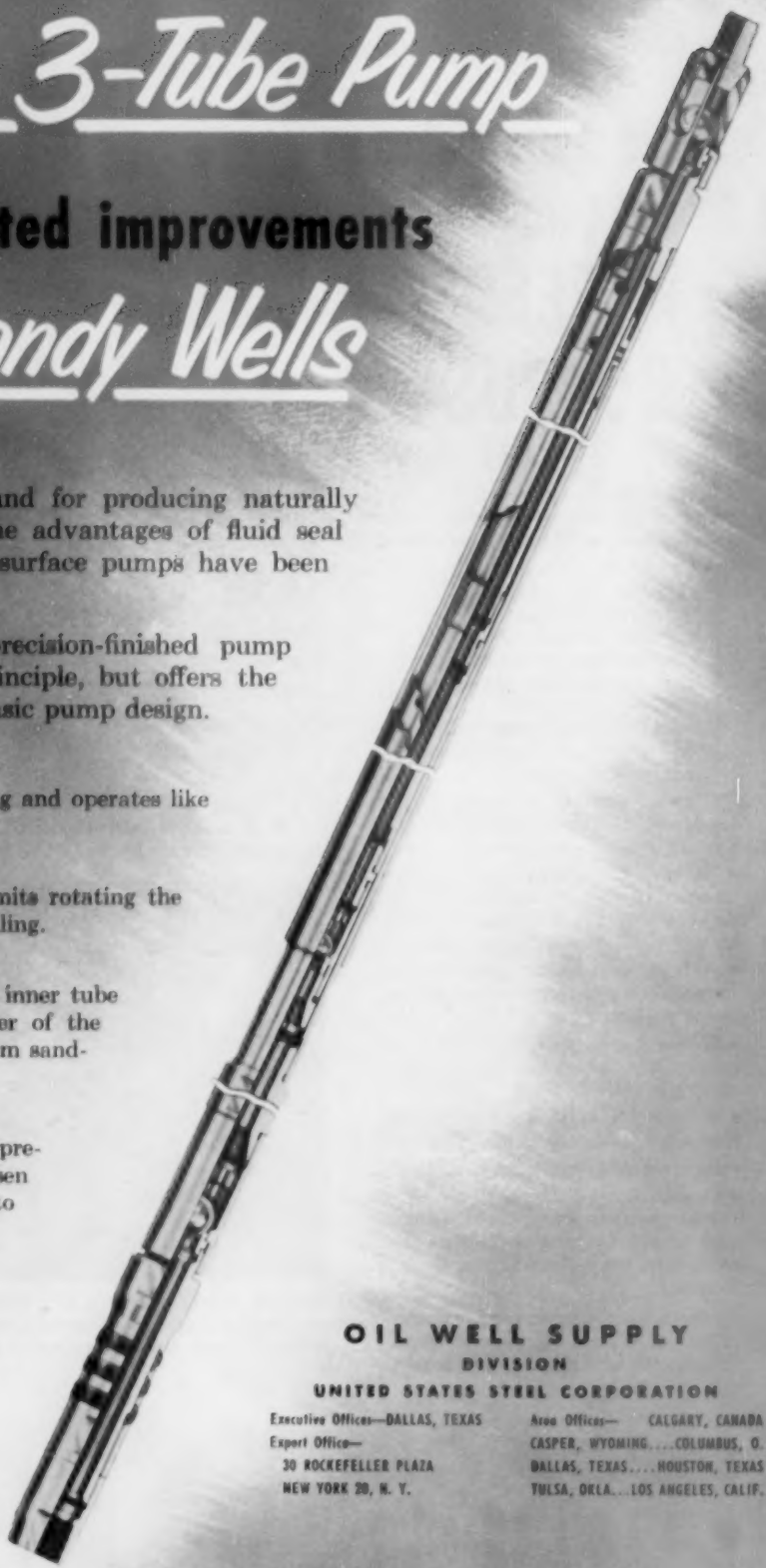
6. You pay no more for its premium quality.



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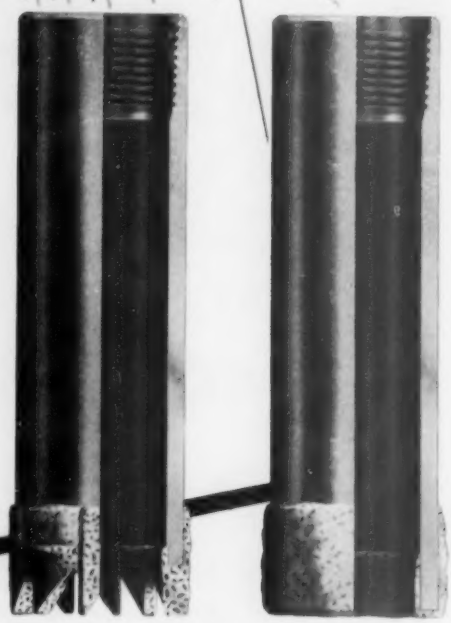
2. White Castle, Louisiana—Using a 9¼" cutting type **HOMCO "Klustrite" Rotary Shoe**, 6340 feet of hole was drilled through tight formations and anhydrite; total drilling time, 5 days.



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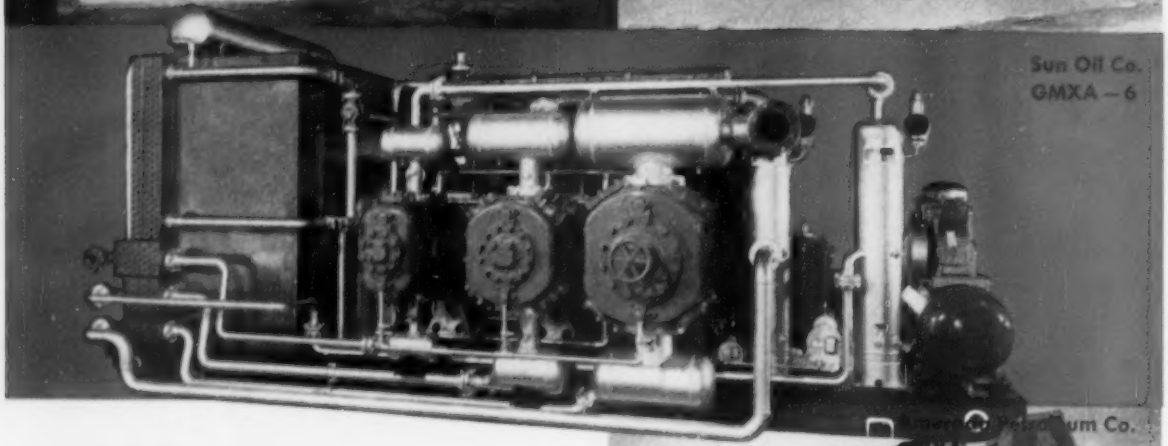
Sun Oil Co.
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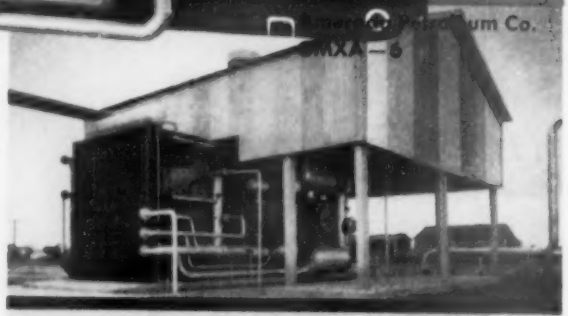

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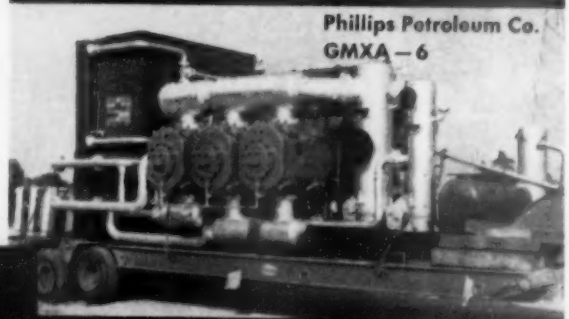

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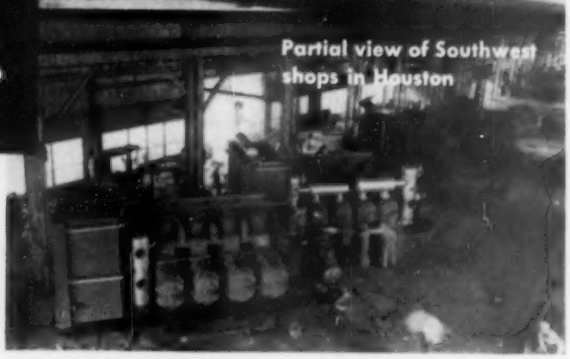
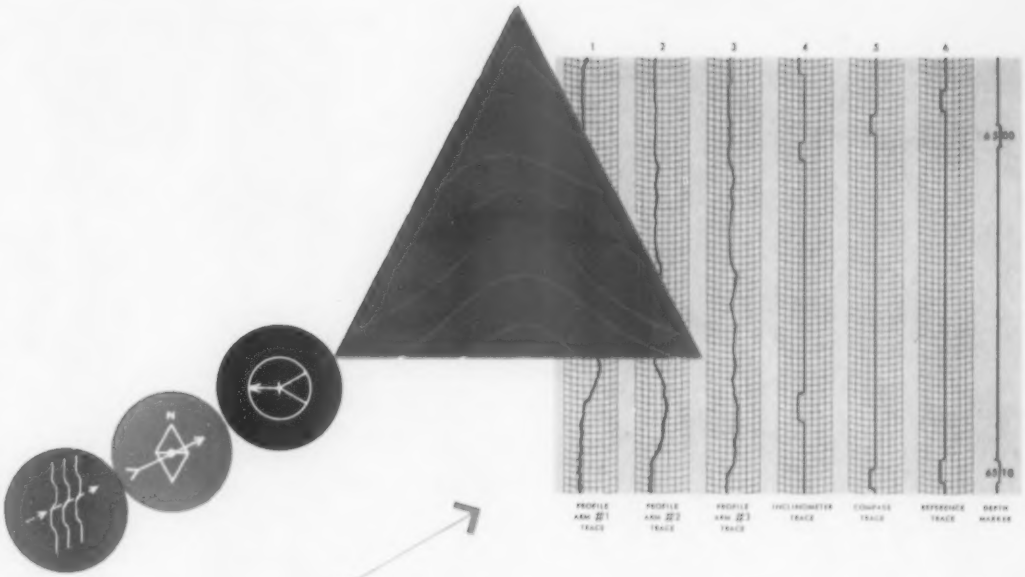

Partial view of Southwest shops in Houston



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An Engineer Talks About W-K-M Valves

INTEROFFICE MEMO

To: Products Approval Committee

From: [signature] Chief Engineer

Subject: Basis for recommending standardizing on W-K-M Valves

Here are the facts substantiating my verbal recommendation about these valves.

1. They have a positive seal on both the upstream and downstream side.

2. Their parallel expanding gate is expanded against the seats with great force by the stem screw, after the gates are in full closing position. The gate moves freely when valve is being opened or closed.

3. Their through-conduit is the same I.D. as the pipe so there is no turbulence to cause erosion.

4. Pressure Seal Bonnets eliminate flanges and studs, self-adjust to temperature changes, and seal tighter as pressure increases.

5. Double row thrust bearings on stem absorb thrust...make opening and closing easier.

6. Lubrication provided by filling body cavity with grease, also inhibits corrosion.

7. Easy field repair while on the line...the entire valve can be repaired without removal.

8. They're available in any size and pressure range we have ever needed, including the new 15,000 p.s.i. working pressure balanced stem valve.

9. They are available with all types of connections: screw ends; weld ends; flange ends; screw by flange ends; unequal flange ends; and special cross types.

10. W-K-M has been making valves for over 30 years, and others I've talked to about them give their unqualified approval on every count. Seems to me it would be to our advantage to standardize on W-K-M Valves.

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A subsidiary of OCF Industries Incorporated

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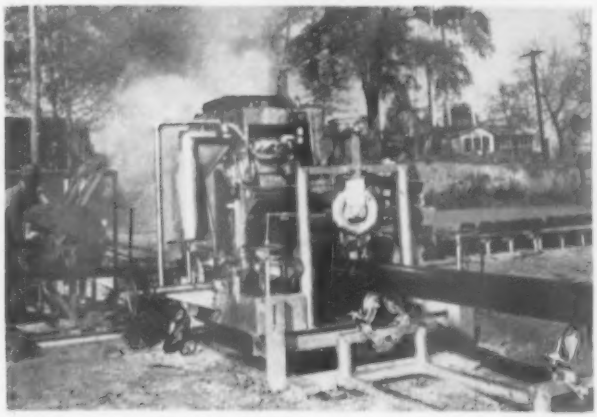

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It meets or exceeds all A.P.I. Requirements and has exceptional weldability. Beginning at the mines, the J&L objective is a product with definite advantages for the customer and his contractor.

The photographs on this page show construction activities along an 8¾" pipe line in southeast Louisiana and southwest Mississippi. Note how easily and safely the J&L line pipe takes the bends. Contractors like to work with it, and owners like the extra service dividends.

J&L PIPE

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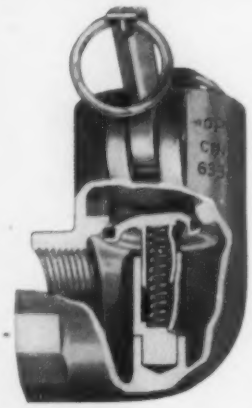
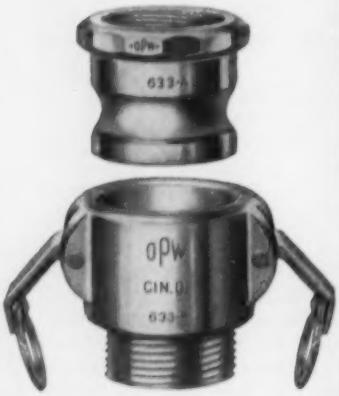
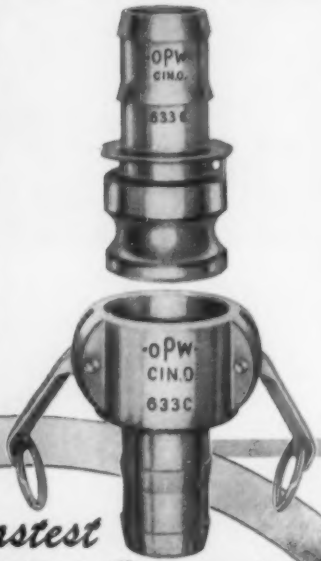
KAMLOK COUPLING ASSEMBLIES







The Fastest Surest Coupling Known!

KAMLOKS positive seal all along the line assures *greater safety* in handling any type of liquid. A perfectly tight no leak connection is made in seconds by sliding coupler over adaptor, then pressing cam levers. No threads to engage, no twisting friction against gaskets, no tools required. KAMLOKS provide long years of economical trouble free service.

Available in any combination to meet coupling requirements in sizes from ¾" to 4" inclusive. Sizes ¾" through 4" of special hard wear-resistant bronze and OPALUMIN (hi-tensile aluminum alloy requiring no additional heat treating). 1" through 4" of monel. 1" and 2" (633A and 633B only) of stainless steel.

Parts A, E, F, are interchangeable with parts B, C, D, G, H, in the same size.

BRONZE • MONEL • ALUMINUM • STAINLESS STEEL

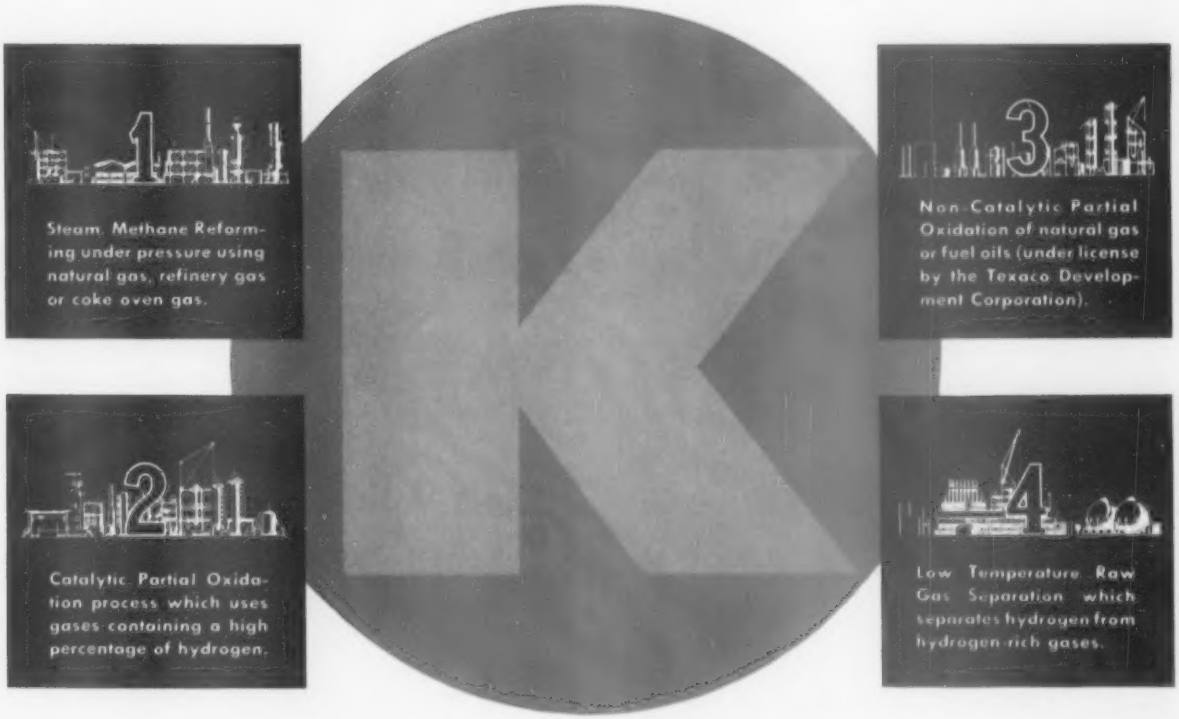
OPW CORPORATION

2731 COLERAIN AVE. • CINCINNATI 25, OHIO

FREE BULLETIN F-10 tells the complete KAMLOK story

OPW CORPORATION — FOR HANDLING HAZARDOUS LIQUIDS — OPW — VALVES · FITTINGS · ASSEMBLIES — CINCINNATI 25, OHIO

The Best Choice of Ammonia Processes


1
Steam Methane Reforming under pressure using natural gas, refinery gas or coke oven gas.
2
Catalytic Partial Oxidation process which uses gases containing a high percentage of hydrogen.
K
3
Non-Catalytic Partial Oxidation of natural gas or fuel oils (under license by the Texaco Development Corporation).
4
Low Temperature Raw Gas Separation which separates hydrogen from hydrogen-rich gases.

Each Designed for Optimum Efficiency at Different Type Locations

The M. W. Kellogg Company offers four different processes, outlined above, for the generation and purification of ammonia synthesis gas. The conversion phase in all uses the Kellogg-developed, quench-type reactor. With these four basic plant types, potential ammonia producers can be sure of a design which gives optimum results under practically any local operating conditions, including power and fuel as well as feed materials.

This flexibility in ammonia plant design is the result of M. W. Kellogg's many years of successful experience in engineering petroleum refineries and petrochemical plants for major producers both in the United States and abroad. For chemical manufacturers and refiners contemplating product improvement or diversification, it is a guarantee of low initial plant cost, high productive yield, and minimum operational costs.

Details of M. W. Kellogg's four basic types of ammonia plants are contained in a recent 12-page booklet, available on request.

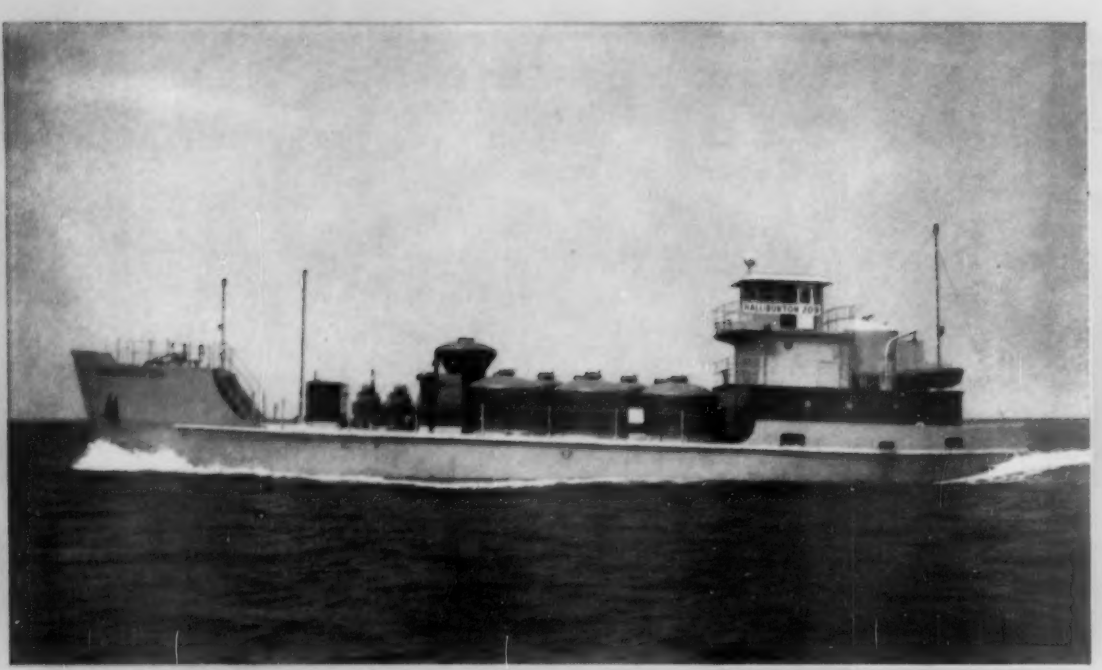
PETROCHEMICAL PROCESSES AND PLANTS

CHEMICAL PROCESS DIVISION

THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.

The Canadian Kellogg Company, Limited, Toronto • Kellogg International Corporation, London

SUBSIDIARIES OF PULLMAN INCORPORATED



Halliburton 209 is 127′ 7″ l.o.a. x 31′ 6″ beam x 5′ draft. Like her Higgins-built sister ship, she has quarters for 8 persons, displaces 366 tons (SW). Powered by two Caterpillar 300 hp Diesels, she carries 6 steel cement silos with 800-sack capacity each and 2 "gel" silos.

Newest Sea-Going Cement Ships For Halliburton Delivered by Higgins Right on Time

When Halliburton Oil Well Cementing Company needed new vessels for its off-shore servicing fleet, they got hold of Higgins. Problem was to construct these big and complicated ships to exact specifications—and to build them fast. Once again Higgins demonstrated that when you have a marine problem—no matter how specialized—it pays to get hold of Higgins. It is Higgins ability to deliver a job *right* on time that has caused more and more firms in the oil and commercial marine industries to award more and more bids to Higgins.

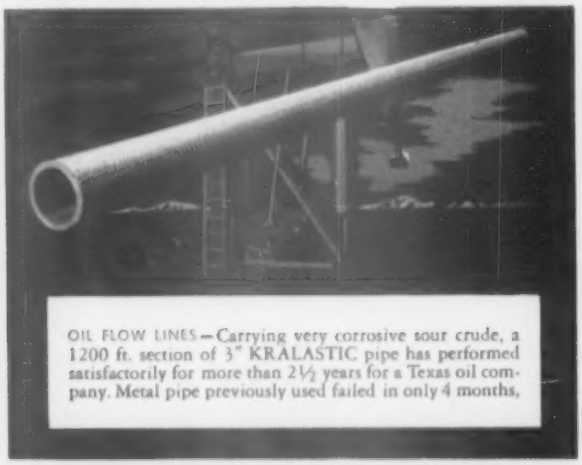
Q. Got a marine problem? A. Get hold of Higgins INC.

Box 8001 • New Orleans 22, La. • CRescent 0631
THE NAME THAT MEANS DEPENDABILITY TO OUR FIGHTING FORCES

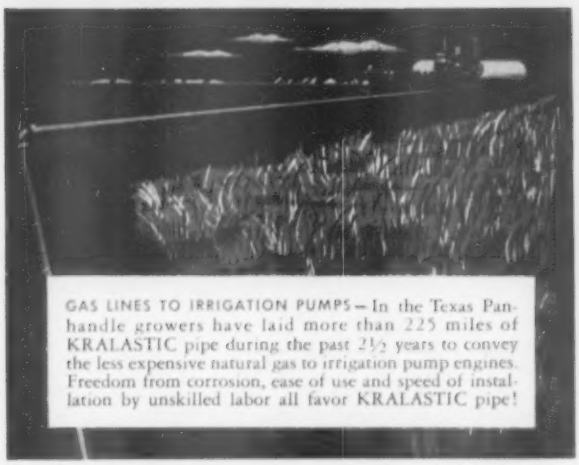
DRILLING BARGES • DREDGES • BARGES • QUARTER BOATS • TUGS • WORK BOATS • COMMUNICATION CRAFT • DRILLING STRUCTURES • PERSONNEL BOATS • PLEASURE BOATS • SEISMOGRAPH BOATS • BULK-TYPE CARGO BARGES • SWAMP SKIPPERS • TANK BARGES • ALSO MARINE REPAIRS OF ALL TYPES

KRALASTIC Corrosion-Proof Pipe Makes Good in Many Fields!

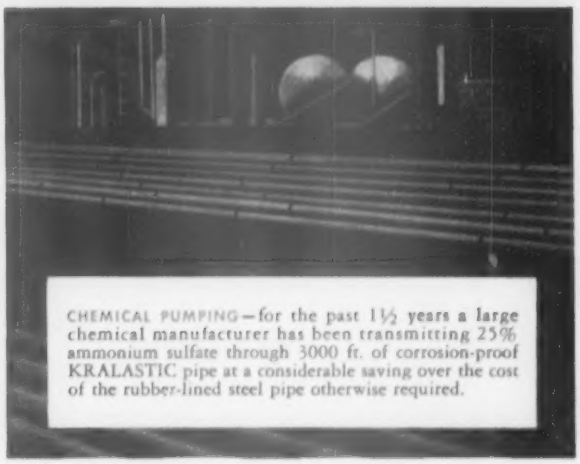
SALT WATER DISPOSAL—Operating under 20" to 28" of vacuum at 110°F. in a Texas oil field, a 4100 ft. stretch of 4" KRALASTIC pipe is still going strong after two years. A previous installation of pipe lasted only 6 weeks.



OIL FLOW LINES—Carrying very corrosive sour crude, a 1200 ft. section of 3" KRALASTIC pipe has performed satisfactorily for more than 2½ years for a Texas oil company. Metal pipe previously used failed in only 4 months.



GAS LINES TO IRRIGATION PUMPS—In the Texas Panhandle growers have laid more than 225 miles of KRALASTIC pipe during the past 2½ years to convey the less expensive natural gas to irrigation pump engines. Freedom from corrosion, ease of use and speed of installation by unskilled labor all favor KRALASTIC pipe!



CHEMICAL PUMPING—for the past 1½ years a large chemical manufacturer has been transmitting 25% ammonium sulfate through 3000 ft. of corrosion-proof KRALASTIC pipe at a considerable saving over the cost of the rubber-lined steel pipe otherwise required.

KRALASTIC pipe is made from a unique combination of plastic and elastomeric materials. It is different both in composition and characteristics from materials used in other types of plastic pipe.

KRALASTIC produces pipe and pipe fittings that are both hard and tough, low in weight, high in tensile strength and unaffected by most chemicals that corrode metals.

KRALASTIC pipe is easily sawed and solvent-welded, or threaded for connection to metal fittings. Be sure the plastic pipe you buy is KRALASTIC. Write us for the names of firms making KRALASTIC® pipe.

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

BRANCHES: Akron • Boston • Gastonia, N.C. • Chicago • Los Angeles • Memphis • New York • Philadelphia • IN CANADA: Naugatuck Chemicals, Elmira, Ontario
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N. Y.

LUFKIN continues to maintain its leadership in the pumping unit field with the NEW C LINE

OF IMPROVED CRANK BALANCED UNITS

OVER 40 SIZES RANGING FROM 4000 LB. POLISHED ROD CAPACITY AND 10,000 IN. LB. PEAK TORQUE TO 30,000 LB. POLISHED ROD CAPACITY AND 640,000 IN. LB. PEAK TORQUE

STANDARD ASSEMBLIES

C-640DB-144-30	
C-640DB-120-30	
C-640DB-108-30	
C-456DB-144-30	
C-456DB-120-30	
C-456DB-108-30	
* C-320D-120-25	
C-320D-84-30	
C-320D-84-27	
C-320D-74-27	C-114DA-54-16A
C-320D-74-25	C-114DA-54-15
C-228D-74-27	C-114DA-54-14
C-228D-74-23	C-114DA-54-13.5
C-228D-74-20	C-114DA-48-14
C-228D-64-23	C-114DA-42-10.5
C-228D-64-20	C-80DB-48-14
C-160D-74-20	C-80DB-42-10.5
C-160D-64-23	C-57D-48-10
C-160D-64-15	C-57D-42-10.5
C-160D-54-18	C-40D-40-7.4
C-160D-54-17	C-40D-34-8
C-114DA-64-15	C-25D-28-6
C-114DA-54-17	C-25D-24-6

These Units Are Also Available With Single Reduction Gear Reducers

The new "C" series offers a greater variety of combinations of torque, counter-balance, and polished rod capacity to suit any conceivable well condition.

LET YOUR LUFKIN REPRESENTATIVE ASSIST IN SELECTING THE PROPER AND MOST ECONOMICAL UNIT FOR YOUR REQUIREMENTS.

EXPLANATION OF UNIT DESIGNATION

* C —For Crank Counterbalance

320D—Gear Reducer (320,000 Lb. In. Peak Torque Double Reduction)

120 —Maximum Stroke (120 Inches)

25 —Peak Polished Rod Capacity (25,000 Lb.)

Lufkin FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

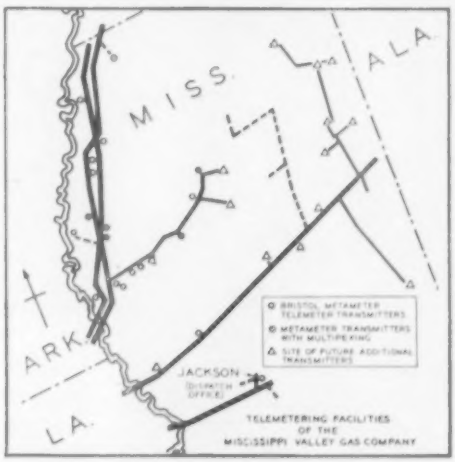
Branch Sales and Service: Houston • Dallas • New York • Tulsa • Los Angeles • Seminole • Oklahoma City • Corpus Christi • Odessa Kilgore • Wichita Falls • Casper, Wyoming • Great Bend, Kansas • Effingham, Illinois • Sterling, Colorado Lafayette, Louisiana • Bakersfield, California • El Dorado, Arkansas

Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD., 14321 108th Avenue, EDMONTON, ALBERTA, CANADA

WHAT'S NEW AT BRISTOL

NERVE CENTER. Central dispatching office of Valley Gas, where dispatcher John Bonner checks the readings of pressure, flow, and temperature at 49 points in the company's distribution system on Bristol Metameter Receivers.

New telemetering system checks 49 functions by phone!



104 COMMUNITIES in northern Mississippi are served by Valley Gas.

Mississippi Valley Gas Company uses Bristol Metameter* Telemeters in most extensive "Selective Calling" telemetering system

By simply dialing a code number on a standard telephone dial, a dispatcher can get a reading on a Bristol Metameter receiver of pressure, flow, or temperature from any one of 49 Metameter transmitters installed at 21 different field locations along Mississippi Valley's retail gas distribution system.

There are also Bristol Time-Multiplexing circuits installed at two communities. With these, the dispatcher can dial one code number and have seven readings from the community in question indicated at the same time on the panel board — thus reducing dialing time. The function and the location being received is indicated by a system of bullseye lights on the panel.

We'd like to tell you how Bristol Metameter Telemeters can help you, too. Write today for free 40-page booklet M1710. Address The Bristol Company, 120 Bristol Road, Waterbury 20, Conn. 4.39

Reg. U.S. Pat. Office

TRADE MARK
BRISTOL'S

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

2000-5000 volt
MOTOR CONTROL

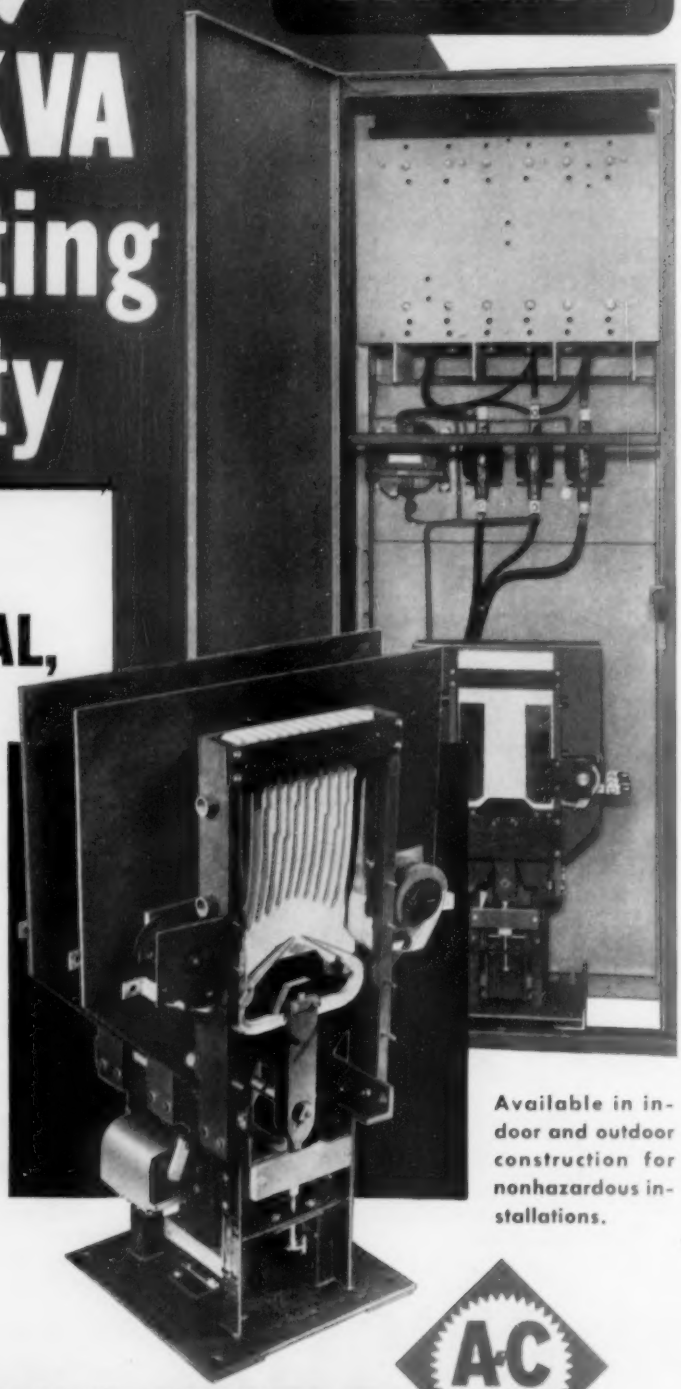
Full 50,000-KVA interrupting capacity

Air-Break Contactor Provides ECONOMICAL, POSITIVE Short-Circuit Protection

Design simplicity is the key to the economy, convenience and SAFETY afforded by the Allis-Chalmers Type 5906 ALC motor control.

This starter is equipped with instantaneous fault current protective devices in addition to the usual thermal overload relays. In this Allis-Chalmers arrangement, the high voltage air contactor provides short-circuit protection up to 50,000 kva. Blade-type disconnect switches, mounted in the top compartment, are used for isolation purposes.

For complete information on Type ALC control and Type 256 air-break contactors, see your A-C representative or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.



Available in indoor and outdoor construction for nonhazardous installations.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A 4659

NATIONAL MOVES A STORE TO THE CUSTOMERS!

Oil men go where the oil is, and National's supply service goes with them. It's a familiar story—recently proven in an unusual way at our Weyburn, Canada, store.

By the time it had been in business about a year, the center of drilling activity in the area had moved over 50 miles away. For customers coming to the store and National men traveling to the rigs, this involved much additional driving—some of it in troublesome weather. These problems were readily solved, however.

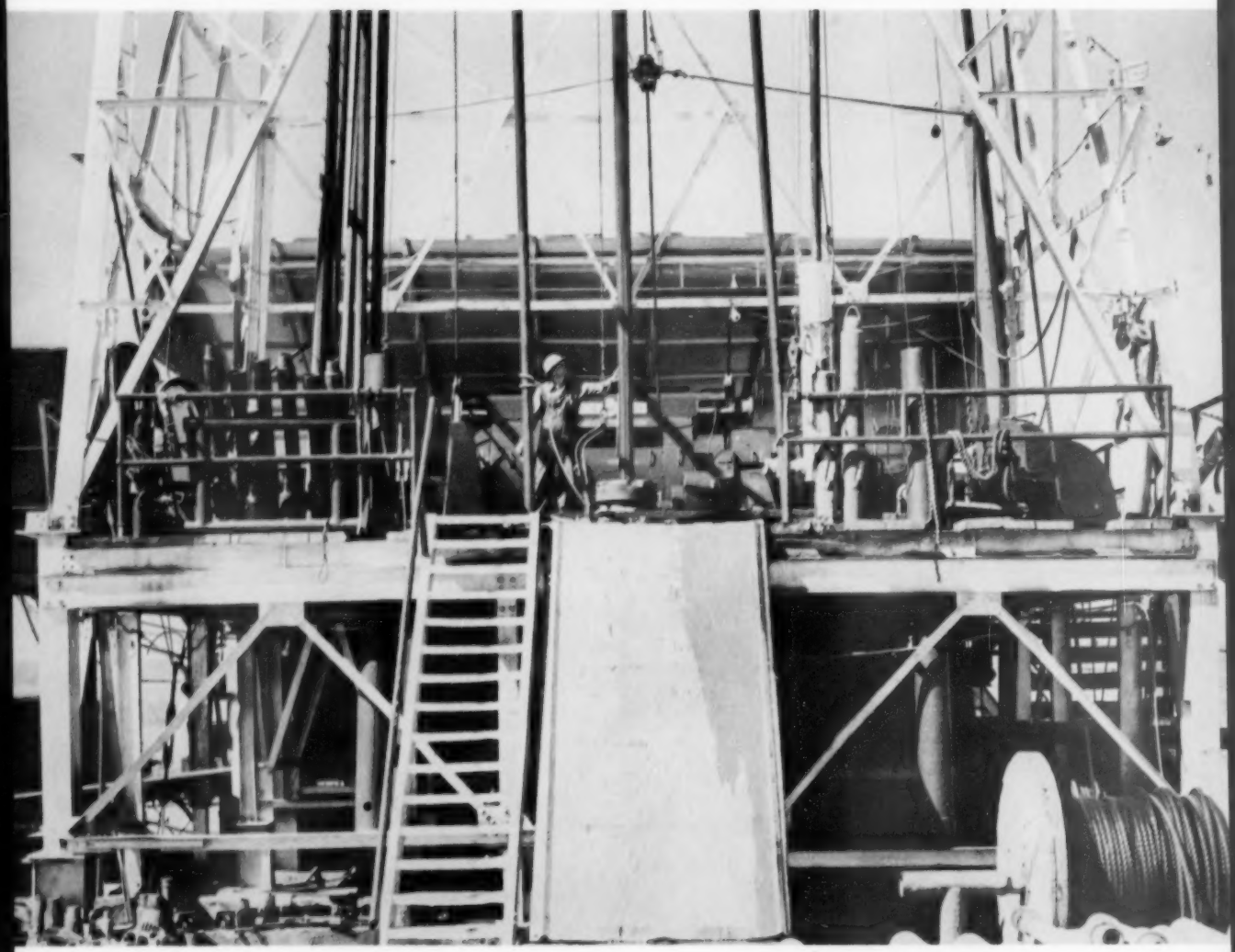
The entire store, a "portable" type developed by National for just such a situation, was moved to the customers! Prefabricated complete with shelves and racks, the store—along with its inventory—was dismantled and loaded onto large trailers. Four days later, after ten truck loads and re-assembly work during adverse weather, the store was open for business 54 miles away from its original location—handy to the customers and promptly meeting their needs!

Most of our 124 stores are too large to be moved in this manner, but the portable store is an effective way of insuring fast service in newly developing or remote fields. As a supply service "first," it's an outstanding example of how National tailors each store's activities to best serve the operators in its territory. You'll find this policy in action, and receive its many benefits, *wherever* you do business with National Supply.

THE
NATIONAL SUPPLY
COMPANY

Need quality protection against drill pipe failures?

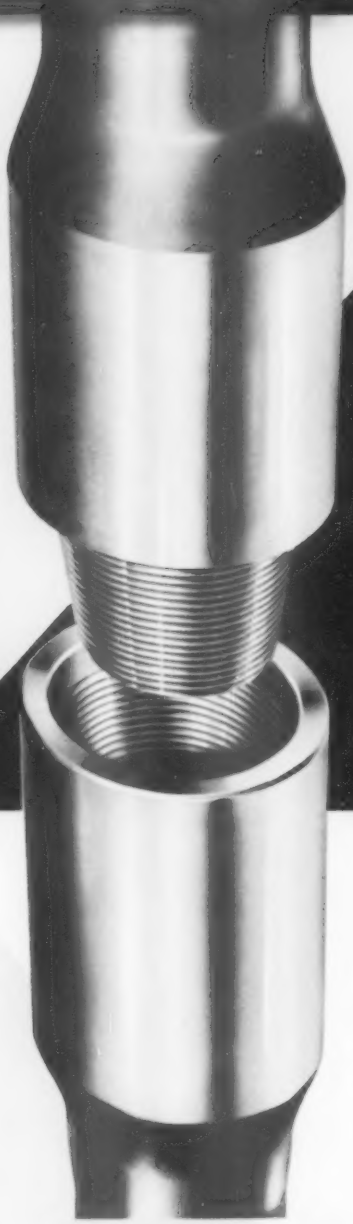
Specify **SPANG®** **DRILL PIPE!**



If the severe stresses and pressures of deep well drilling have caused costly drill pipe failures in your operations, you'll find it profitable to use these top-quality SPANG Tubular Products. Developed to withstand hard service, both Spangweld and SPANG Double Seal Shrink Thread Drill Pipe are highly resistant to leakage, fatigue, tension and corrosion* failures.

You can see the reasons for this stamina by examining both types of tool joints. Streamlined Spangweld Drill Pipe has only one-third of the number of threaded elements in conventional drill pipe and tool joints. In SPANG Double Seal Shrink Thread tool joints, two precision metal-to-metal seals eliminate leakage and washouts and prevent fluid entry into the threads. Whenever necessary, SPANG Double Seal Shrink Thread tool joints can be easily and quickly replaced at the rig.

For highly abrasive service conditions, Spangweld and SPANG Double Seal Shrink Thread tool joints are available with several types of hard facing. All of these quality features are outstanding reasons why it pays you to specify SPANG Drill Pipe and Tool Joints.



two types
to meet your needs!

SPANGWELD
DRILL PIPE

- Joints flash-welded to drill pipe
- Streamlined exterior contour
- Threaded elements reduced
- Sizes for every drilling requirement, including slim hole operations

SPANG

DOUBLE SEAL SHRINK THREAD DRILL PIPE

- Completely seals against internal and external pressures
- Joints rapidly replaced at the rig

** You'll get maximum corrosion resistance when you specify Spang Plastic Coating!*

Sixteen uniform coats of baked, phenolic plastic are applied to the interior surface after carefully-controlled shot-blasting and cleaning operations at the mill. Ask the National representative in your area about this service—and any other details you'd like to have about SPANG Drill Pipe.

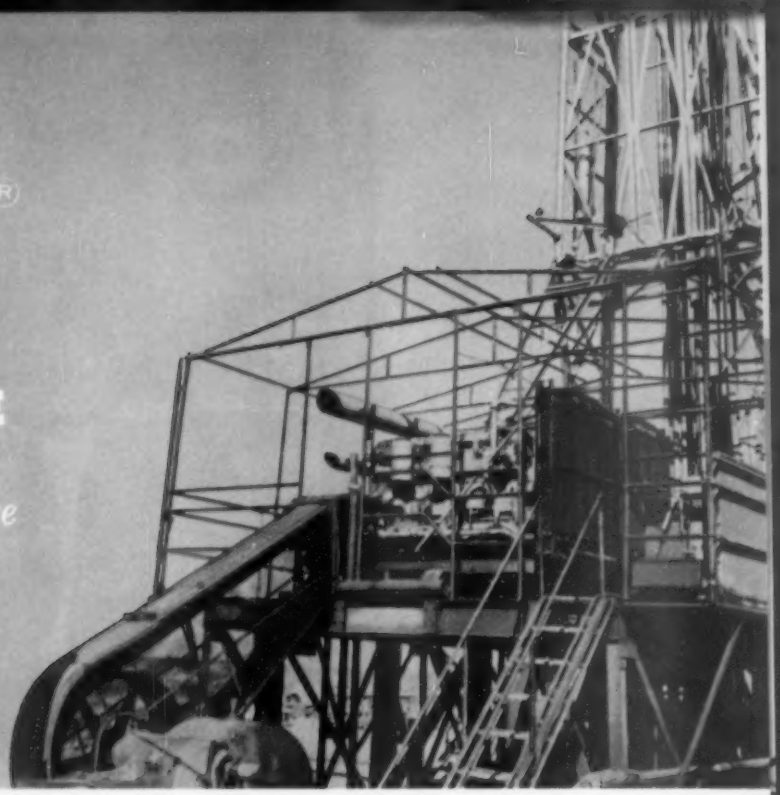
THE
NATIONAL SUPPLY
COMPANY

SPANG-CHALFANT DIVISION
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Ft. Worth, Texas; Los Angeles, California; Toledo, Ohio; Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

Want a top-quality pipe for general service work? See the next page . . .

SPANG®
CW
STEEL PIPE

made for rugged service on many oil field jobs!



For waterflooding lines . . .

air lines **gas lines**

water systems

oil gathering systems

salt water disposal lines

roof rails and exhaust lines

Proved as a top-quality pipe for general service work, SPANG CW Steel Pipe does a dependable job *wherever* you use it.

That's because SPANG CW is made of top grade steel . . . is quality controlled during manufacturing . . . has strong, clean uniform welds and a smooth, clean finish. Thorough tests and inspections before shipping insure its top strength and long service life—and you get a rugged product, easy to work with and install.

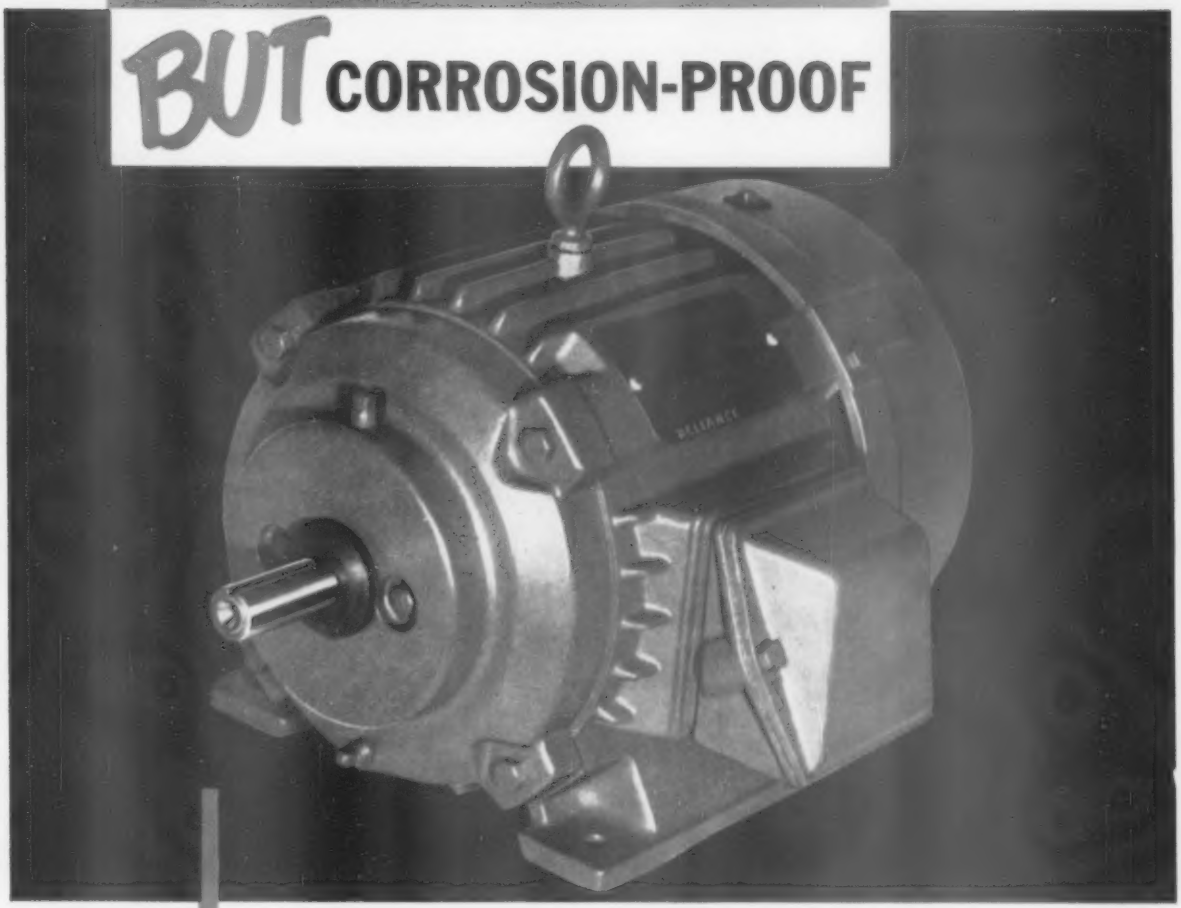
SPANG CW costs no more than pipe produced under less exacting conditions, so try it on your next job. You'll find a full range of sizes available at all National Supply Stores.

THE
NATIONAL SUPPLY
COMPANY

SPANG-CHALFANT DIVISION
MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION TUBULAR OFFICES: Denver, Colorado; Houston, Texas; Ft. Worth, Texas; Los Angeles, California; Toledo, Ohio; Tulsa, Oklahoma; Calgary, Alberta, Canada
NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

Not Just CORROSION-RESISTANT

BUT CORROSION-PROOF



Corrosion resistance is not enough to stop acids or alkalies from chewing up a motor in a hurry. That is why the wise engineer selects Reliance Corrosion-Proof Motors for corrosive service.

These motors are built to withstand the onslaught of destructive chemicals for years. Housings are made of virtually indestructible cast iron. Exterior contours are designed to slough off liquids—no nooks and crannies to retain corrosive elements. Enclosures are sealed to prevent any leakage . . . Metermatic lubrication systems provide complete protection against burned out bearings and contaminated lubricants.

Anyway you look at them, Reliance Corrosion-Proof Motors can take it—and you're not limited in the choice of motors either. A complete line of a-c. motors, 1 thru 300 hp., is available in all mountings, frequencies and voltages.

Why not call your Reliance representative today and get all the details.

B-1505

RELIANCE *Totally-Protected* MOTORS

RELIANCE ELECTRIC AND ENGINEERING CO.

Cleveland 10, Ohio • Offices in Principal Cities

Canadian Division: Welland, Ontario

A PICTURE REPORT OF

INTERNATIONAL POWER *in action!*

Boosting job production everywhere

6 years, no overhauls—TD-14 with Superior Pipe-Boom, rear right, was bought by Luther Harper, Turley, Oklahoma pipe-layer, in 1949. In 10,000 hours since then, it has needed no major overhauls. TD-14, with Superior Boom, foreground, newest of Harper's 6 International crawlers, was bought for this job—laying 3½ miles of 12 inch gas line in East Tulsa. Last year, Mr. Harper's 6-unit IH fleet put in or removed 160 miles of pipe, some 24 inches in diameter.

120 IH engines for L. B. Johnson, used by this Kiefer (Okla.) company on wells near Tulsa. Here, Master Mechanic Joe Vanardel inspects a 24 hp U-2A which pumps a 1700-ft. well. "International engines are easy to work on and low in maintenance cost," he says. "Some of our units haven't needed any work in 4 years. Others, on continuous hard-pumping wells, easily run a year, 24 hours a day, between overhauls."

Contract-drilling in Louisiana, Lloyd & Langston report the 83 hp butane-burning International engine which powers their drill rig "has needed no repairs in 2 years of use." Rig is shown drilling 3500-ft. well at Hosston.

Digs oil reserve pit—That's just one of many tasks Dick Sieber Excavating Co., Pauls Valley, Oklahoma, assigns their 4 TD-14's. "New TD-14's provide solid comfort," says Operator Lloyd Nelson. "I can really relax in the big, soft seat. Operation is simpler, too. Controls are handy—right where I can reach them naturally. And I'm sure going to appreciate the open deck on those hot days next summer!"

Welds 55 mi. gas line—two 40-volt welders on TD-14 provide power for stringing line, Seneca, West Virginia, to Woodstock, Virginia. Pipeline Construction & Drilling Company, Camp Hill, Pennsylvania, weld 2,500 feet daily with this rig.

Clears 50-ft. right-of-way—Clearing on same job described left is being done by TD-24 shown, plus 2 TD-18's and 2 TD-9's. Despite rough, rocky, mountainous terrain and 4500-ft. altitude, fleet clears an average of ½ mile per day.

"Best for backfilling" says R. M. Paylor, Pipeline Construction & Drilling Co. foreman, of International Drott TD-9. "It has highest reach and best balance of any equal-size loader. Hydro-spring sure saves wear in rough rock work."

International Industrial Power

INTERNATIONAL HARVESTER

A machine size for every job . . . see your nearest INTERNATIONAL DISTRIBUTOR for details.

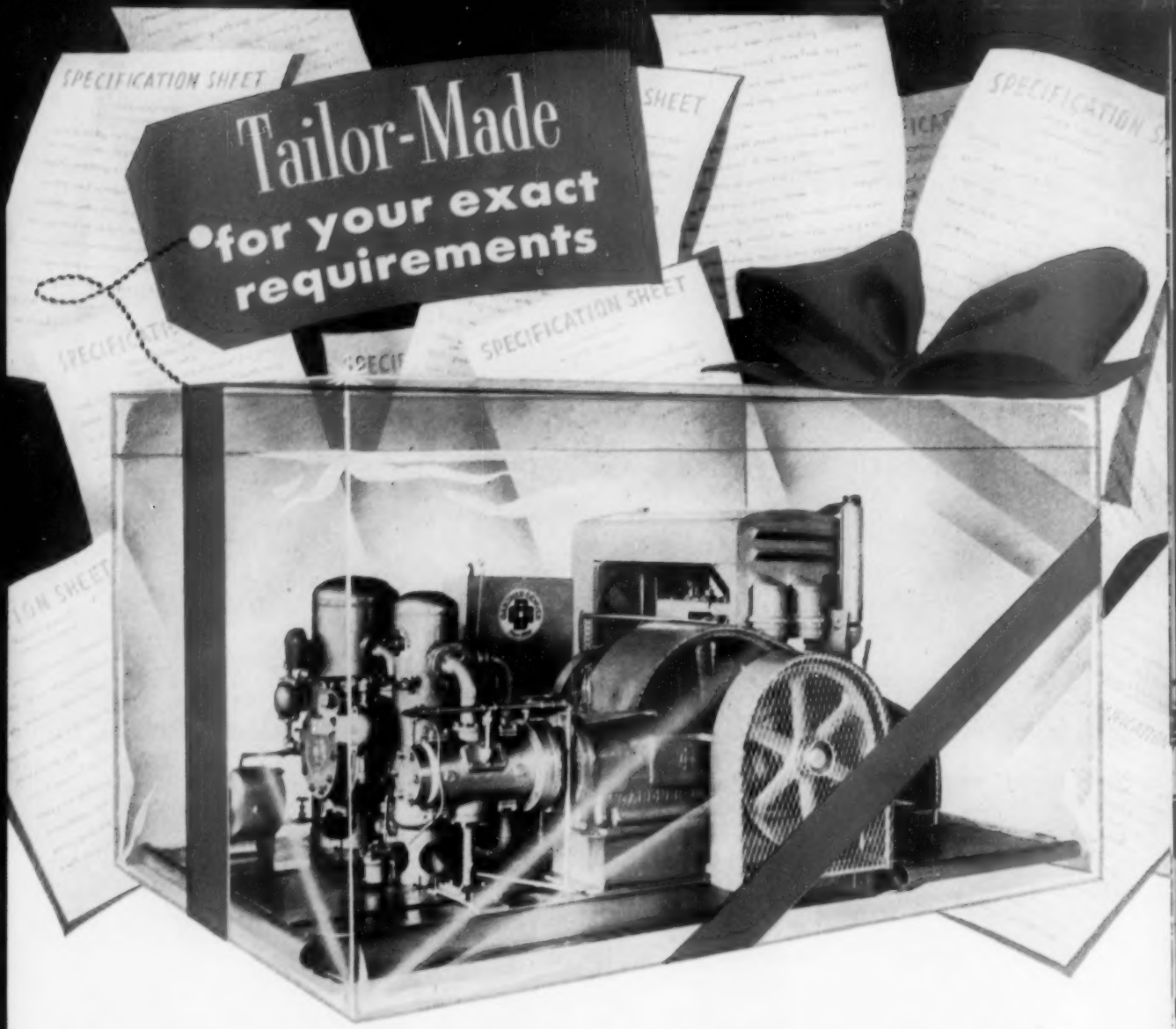
PAYSCRAPERS
13 yd. and 18½ yd.

SUPERIOR PIPE-BOOMS
4 Models . . . lift 15,100 to 90,000 lbs.

CRAWLER TRACTORS
4 Models . . . 40 to 200 hp

DIESEL, GAS ENGINES
18 Models . . . 14½ to 200 hp

Also: International Drott Loaders . . . International Wheel Tractors . . . International Scrapers, Bottom-Dumps . . . Wire Rope and Other Supplies.



. . . and delivered as a COMPLETE PACKAGE!

GARDNER-DENVER COMPRESSORS

for BOOSTER SERVICE . . . GAS INJECTION . . . AIR-GAS LIFT

Designed specifically for your requirements, Gardner-Denver packaged compressors come in capacities and pressure ranges for all field conditions.

Sizes from 5 to 300 h.p. . . . Portable or stationary models . . . Single stage or two-stage units . . . Vertical or horizontal compressors . . . Electric motor or gas engine drive . . . Complete, compact units — ready to hook up and operate.

EFFICIENT—DEPENDABLE—ECONOMICAL

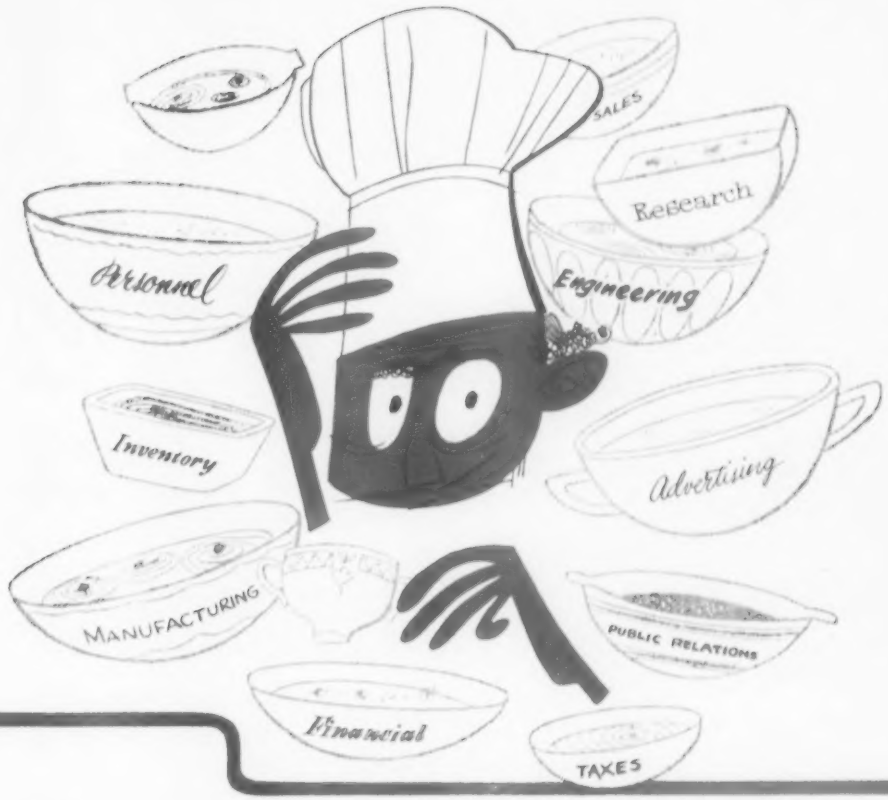
CONTINENTAL

Serving the Oil and Gas Industries

THE CONTINENTAL SUPPLY COMPANY

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World



Too many soups spoil the cook

The independent business man has many problems to face each day, problems connected with each of the many phases of his business. The officers of The National Bank of Commerce are qualified by training and experience to assist you in finding a solution to many of these problems. This experience can be put to work for your company when you make The National Bank of Commerce your bank. Complete, modern banking facilities are available for all our industrial depositors.

THE NATIONAL BANK OF COMMERCE

OF HOUSTON

Gulf Building, Houston, Texas "The Bank for All the People"

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Thank You

FOR YOUR PATIENCE!

Our big fire last August caused a delay in deliveries to a number of our customers. While the fire is practically forgotten now, we shall never forget the wonderful cooperation and understanding we received from you, our valued customers. To each of you, all of us at A. O. Smith wish to say,

"Many thanks!"

Through research ...*a better way*

A.O.Smith
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METER PRODUCTS

FACTORIES: 5715 Smithway St., Los Angeles 22, Calif., P.O. Box 500, Succasunna, New Jersey
OFFICES: Atlanta, Chicago 7, Houston 20, Los Angeles 22, New York 17
CANADA: Toronto 12, Vancouver 1 ... INTERNATIONAL DIVISION: Milwaukee 1, Wisconsin

Report on the MICHIGAN TURBO-DOZER:

New dozer features 27 mph speed, power-tilting bowl, rear-wheel steer

The new 2¾ yd. capacity Michigan Turbo-Dozer combines rubber-tired speed and mobility with outstanding traction and power. Its turbocharged diesel engine develops 165 hp, with maximum rimpull of 28,000 lbs.—plenty of power for heavy dozing, push-loading and land clearing. At 27 mph, it runs rings around any dozer on the market!

Power-tilting bowl. A powerful double-acting hydraulic cylinder tilts the bowl back and forth through a 33 degree arc. You can change the angle of the bowl from "dig" to "float" as you travel—work the cutting edge back and forth under stumps and boulders to uproot them. Two 6-inch lift cylinders give you tremendous lifting power and down-pressure—you can raise the cutting edge from 24¼ inches below ground level to 43¾ inches above.

High flotation tires, oscillating axle. Big 18.00-25 low pressure tires (nearly 7-foot tread) give the Turbo-Dozer excellent ground contact in dry, wet or sandy footing. You can cross railroad tracks or travel along the ties or road bed; you can climb curbs and drive safely on any kind of road surface. On uneven terrain, the steering-drive axle oscillates to keep both rear wheels in firm contact with the ground. With 14½ inches of ground clearance underneath, it's practically impossible to get "hung up"

Full traction while turning. The Turbo-Dozer gives you full tractive effort even in a turn. *All four wheels are always driving*, except when you declutch the rear axle for highway travel. Rear-wheel steering eliminates unnecessary tire wear —you don't brake or drag your inside wheels on a turn. If one wheel begins to slip, a locking differential automatically applies power to the wheel with the firmest footing.

Power-shifting, 300% torque multiplication. Clark's exclusive power-shift transmission eliminates the conventional engine clutch and foot pedal—the most notorious cause of excessive maintenance and operator fatigue. With two finger-tip levers on the steering column, the operator can instantly shift between High-Low and Forward-Reverse—even when moving in either direction.

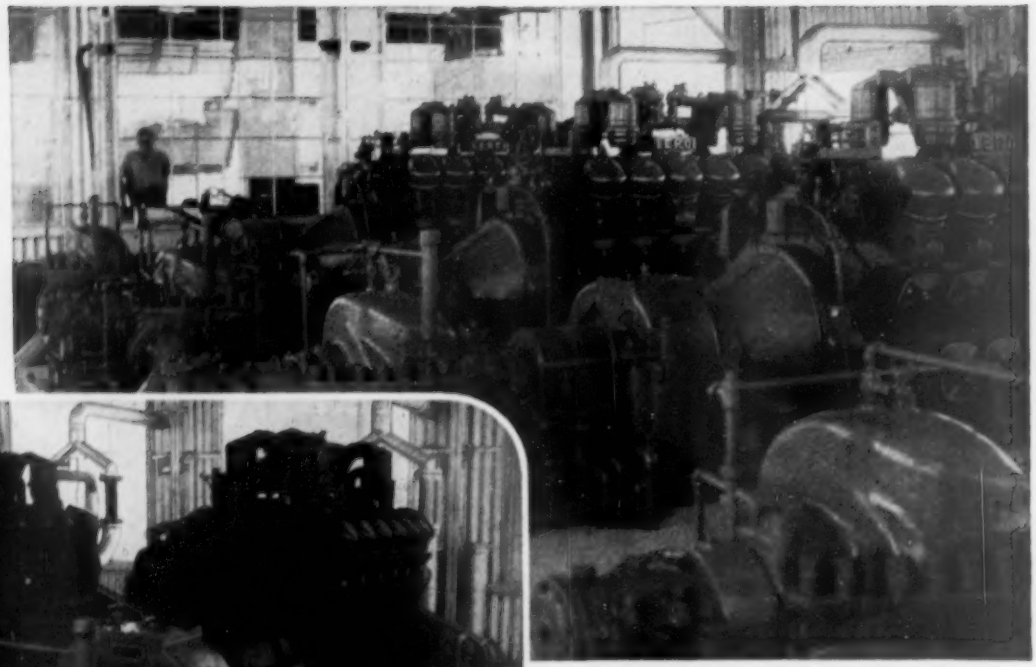
The 3-to-1 Clark torque converter gives you a steady power flow, regardless of speed. As the load gets heavier the torque output automatically increases up to 300% at stall speed—gives you the extra torque to plow through the toughest spots. You can't stall the engine, and there's no clutch to slip.

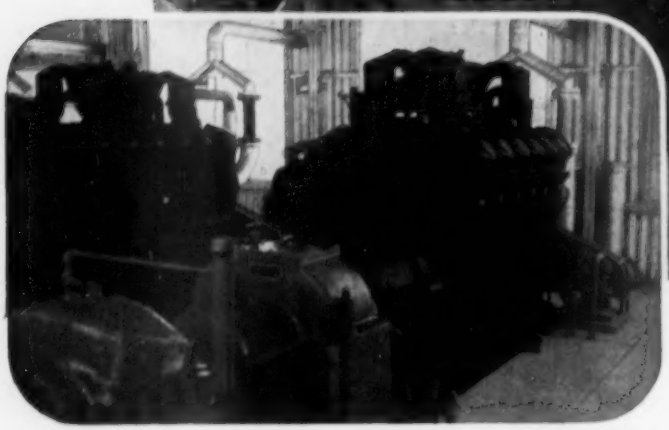
Prove it for yourself. The new Michigan Turbo-Dozer gives you faster cycles and more yardage in every shift—more dollars of profit every day. Ask your local Michigan distributor to prove it, with an on-the-job demonstration; or write direct for detailed specifications. The Turbo-Dozer is available on the low-cost Michigan Lease Plan: no down payment, pay as it produces!

MICHIGAN is a trade-mark of Clark Equipment Co.

CLARK EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
448 Second Street
Benton Harbor 35, Michigan





Four Le Roi L3460 engines in a pipeline station owned by a major oil company. Three of them have been in continuous operation for six years. None have undergone a major overhaul.

Power-Packed Pipeline Station

. . . uses Le Roi L3460's to provide plenty of low-cost pumping power

Le Roi's L3460 with 600 max. hp. and its bigger brother, the L4000 with 655 max. hp., are ideal for pipeline service on many counts. Here's why:

Plenty of power with good fuel economy — These engines develop 600 and 655 max. hp. with rock-bottom fuel consumption, and can be run on natural gas, gasoline, or butane. Advanced design manifolding, low friction bearings, and low power loss to accessories, all contribute to unusual operating economy.

Long engine life—Perhaps the best proof of this statement is found in the trouble-free performance experienced by users in installations like the one shown above. Basically the L3460 and L4000 are compact, high-output engines designed with short stroke to give you greater horsepower and speed, without compromising engine life. And that's exactly what they do for you.

More comfortable operating conditions—Water-cooled exhaust manifold cuts down engine heat in operating areas, yet provides fast engine warm-up. The smooth, clean lines of these engines prevent dirt from collecting —that's why they are so easy to keep clean.

Compact V-12 design packs a lot of horsepower in a small space—to give you more horsepower per dollar. This, plus vibrationless performance, reduces foundation costs, simplifies installation.

We think that if you see an L3460 or L4000 in operation you'll agree that they provide the answer to low-cost pumping power. Have your supply house or Le Roi distributor show you one at work. Bulletins are available upon request—just write us.

P-140

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

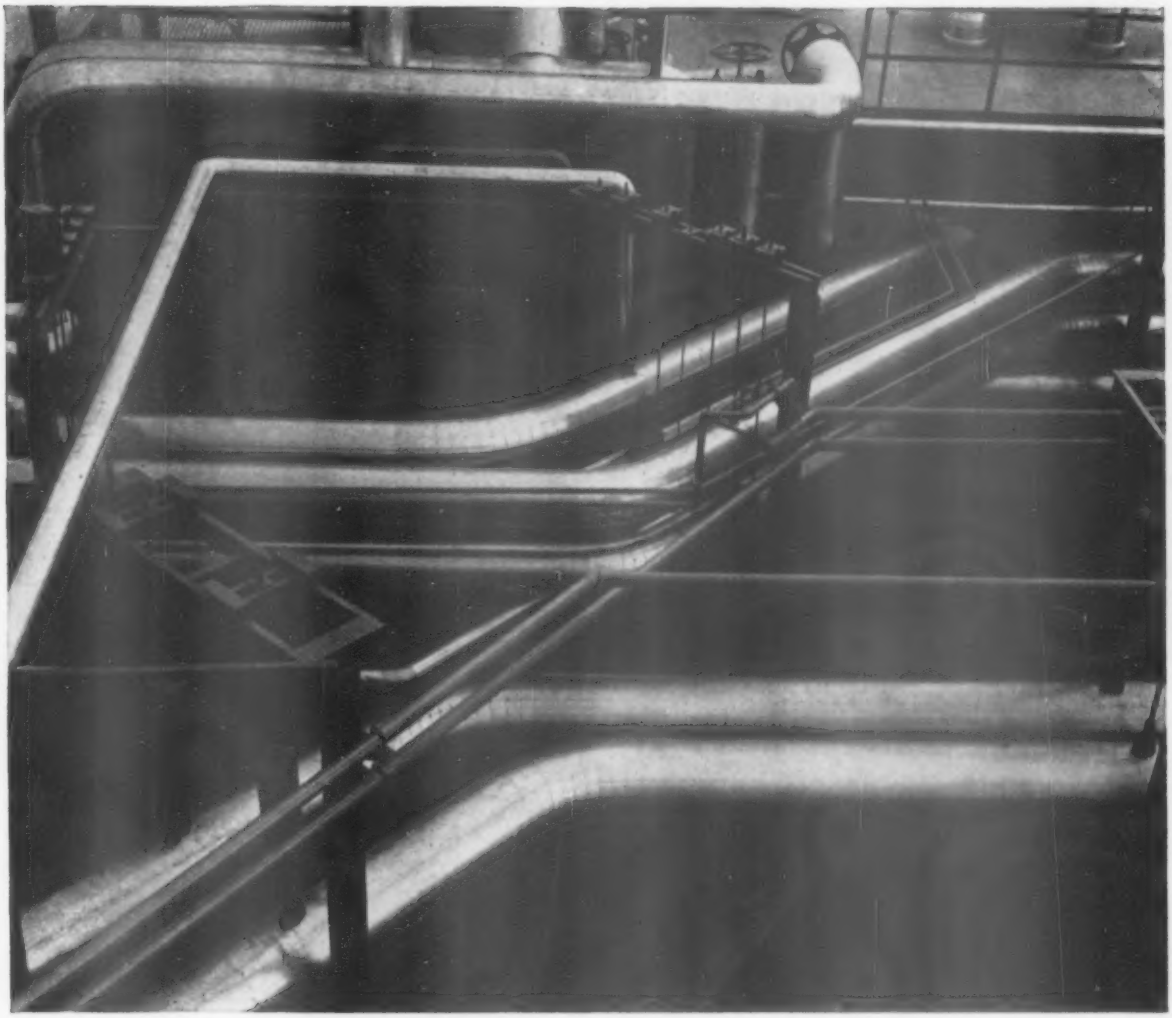
PORTABLE AIR COMPRESSORS

TRACTAIR

STATIONARY AIR COMPRESSORS

AIR TOOLS

ENGINES



Unibestos lets steam pack more power

When high-pressure steam lines are protected with Unibestos, less heat escapes . . . more live steam is available for efficient power production.

Made of Amosite, Unibestos has strong, interlacing fibers that provide superior insulating protection with only *single-layer construction.* Easy to install, Unibestos is tough, durable insulation that withstands vibration . . . doesn't shatter even under extraordinary impact . . . inhibits corrosion. Built to last, it can be used over and over again without impairing its unmatched insulating properties. Unibestos® pipe insulation is available in sectional form through 44″ O.D.

Write for **Free** descriptive Bulletin 109C.

UNARCO

Joe Bestos says:

. . . Remember, single-layer Unibestos locks in more heat than most *double-layer* insulations!

UNION ASBESTOS & RUBBER COMPANY

1111 West Perry Street • Bloomington, Illinois

The New Rotary Drilling Line

HAZARD

Lay-Set

VHS

15% Stronger

Users Are Enthusiastic over Rotary Drilling Lines of Lay-Set VHS . . . New Wire Rope that's 15% Stronger, and Tougher

HIGHER FACTOR OF SAFETY Rotary drilling lines made from new Lay-Set VHS wire rope are at least 15% stronger than those made from Improved Plow Steel which has been the strongest grade available up to now. Careful calculations show that the factor of safety for 10 lines of VHS is 15% greater than the factor of safety for 10 lines of IPS rope. Or, in other words, the factor of safety for 10 lines of VHS is almost identical to the factor of safety for 12 lines of IPS.

DRILL DEEPER AND FASTER • VHS's greater strength therefore means that you can drill deeper before increasing the number of parts of line. You can make round trips faster.

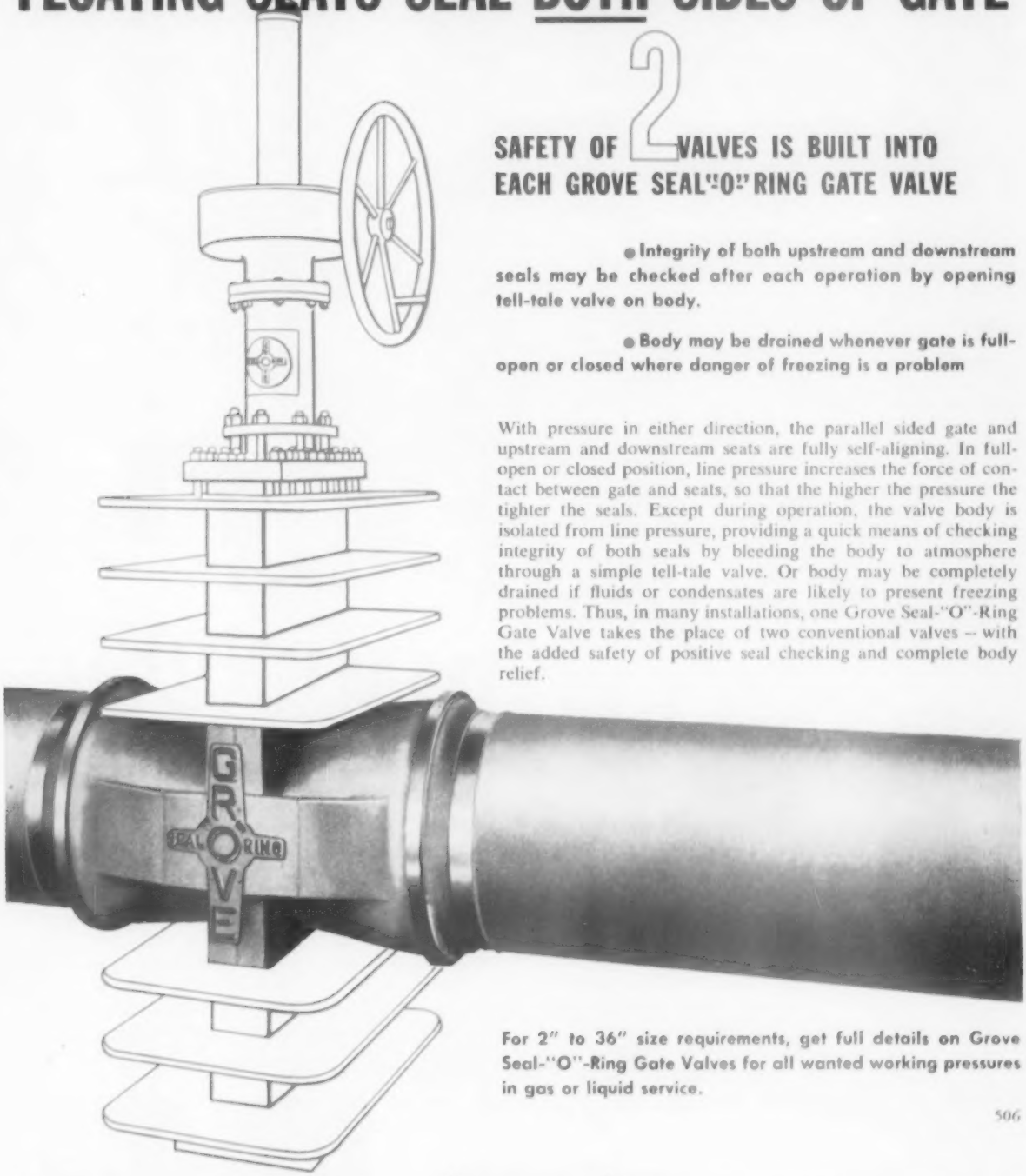
TOUGHER • New VHS is not only stronger—it's also tougher. And it has all the advantages of Preformed construction. It is so good that we have a hard time keeping up with the demand for this superior rope from the drilling industry.

EASY TO ORDER • You don't need any complicated specifications to order new Lay-Set VHS. Just call your Hazard distributor and tell him you want a new Lay-Set VHS drilling line, giving the size you require. Ask your Hazard Distributor for Lay-Set VHS or write the nearest Hazard office for a copy of **Brochure DH490.**

HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.

PLANTS: Houston, Tex., Wilkes-Barre, Pa.
OFFICES AND WAREHOUSES: Odessa, Tex., San Francisco, Portland, Ore., Pittsburgh, Philadelphia, New York, Los Angeles, Denver, Chicago, Atlanta • Bridgeport, Conn.

FLOATING SEATS SEAL BOTH SIDES OF GATE



SAFETY OF 2 VALVES IS BUILT INTO EACH GROVE SEAL-"O"-RING GATE VALVE

- **Integrity of both upstream and downstream seals may be checked after each operation by opening tell-tale valve on body.**

- **Body may be drained whenever gate is full-open or closed where danger of freezing is a problem**

With pressure in either direction, the parallel sided gate and upstream and downstream seats are fully self-aligning. In full-open or closed position, line pressure increases the force of contact between gate and seats, so that the higher the pressure the tighter the seals. Except during operation, the valve body is isolated from line pressure, providing a quick means of checking integrity of both seals by bleeding the body to atmosphere through a simple tell-tale valve. Or body may be completely drained if fluids or condensates are likely to present freezing problems. Thus, in many installations, one Grove Seal-"O"-Ring Gate Valve takes the place of two conventional valves – with the added safety of positive seal checking and complete body relief.

For 2" to 36" size requirements, get full details on Grove Seal-"O"-Ring Gate Valves for all wanted working pressures in gas or liquid service.

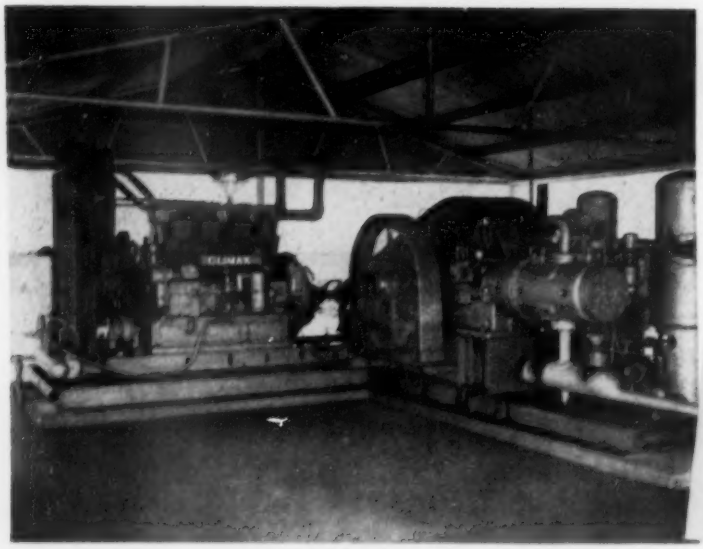
506

GROVE SEAL-"O"-RING Gate Valves

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, California
HOUSTON 4 – 1901 Calumet St. • • • • • • • • **LOS ANGELES 6** – 1930 W. Olympic Blvd.

ODESSA, TEX. • TULSA, OKLA. • LAFAYETTE, LA. • CHICAGO, ILL. • DENVER, COLO. • In Western Canada: GROVE VALVE LIMITED

GROVE SEAL RING
GROVE SIMPLICITY ACCURACY SAFETY



One of two Climax V-85 installations at Tex-Penn's Plymouth Field near Corpus Christi, Texas. Engines drive gas compressors on a closed jet system.

A Climax V-85, 8 cylinder, 7½ x 7 engine with 2474 Cubic Inch Displacement.

Climax Engines are FIELD RECOMMENDED

Mr. F. F. Dueser, production superintendent, states that he is "well satisfied" with his Climax engines. Both V-85 Units operate on a 24-hour per day, 365 day yearly basis and minimum downtime has been encountered since installation. "In addition, my Climax engines give excellent performance, operate at low cost per horsepower and are dependable," comments Mr. Dueser, "and I strongly recommend them for any similar oil field applications."

CHECK THESE IMPORTANT FEATURES OF CLIMAX V AND K SERIES ENGINES

- *All models have renewable cylinder sleeves.*
- *All intake and exhaust valves are free-to-rotate type.*
- *All crankshafts are supported by bearings on each side of each crankthrow.*
- *All connecting rods are rifle drilled for pressure lubrication of piston pins.*
- *All cylinder heads have Climax high-turbulence type combustion chambers which produce maximum fuel economy.*
- *All models have the Climax consistent design that makes possible maximum interchangeability of wearing parts.*

Write today for your copy of Bulletin SA-611, "Special Units for Gas Compressors."

WHERE POWER IS YOUR PROBLEM — CLIMAX IS YOUR ANSWER

climax BLUE STREAK ENGINES

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Drillers Machine Shop, Oklahoma City, Okla.
•
Vern Walton Co., Coolidge, Casa Grande & Marana, Ariz.
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Wilson's Engine & Equipment Co., Bakersfield & Long Beach, Calif.
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Cullander Machinery Co., Belzoni, Miss. & West Memphis, Ark.
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CLIMAX ENGINE AND PUMP MFG. CO.
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FACTORY • CLINTON, IOWA
DISTRICT OFFICE • 155 CONTINENTAL AVE., DALLAS 7, TEXAS

MOTORISTS KNOW NOTHING ABOUT THESE ADDITIVES BUT THEY'D MISS 'EM IF GASOLINE DIDN'T HAVE THEM

Tenamene

EASTMAN GASOLINE ADDITIVES

Behind the performance of gasoline, the protection of the gum-inhibiting Tenamenes. Behind the Tenamenes, the interested technical service of Eastman—men and company—ready at short notice to solve refinery inhibitor problems on the spot.

SALES OFFICES: **Eastman Chemical Products, Inc.,** Kingsport, Tennessee; New York—260 Madison Ave.; Framingham, Mass.—65 Concord St.; Cincinnati—Carew Tower; Cleveland—Terminal Tower Bldg.; Chicago—360 N. Michigan Ave.; St. Louis—Continental Bldg.; Houston—412 Main St. **West Coast: Wilson Meyer Co.,** San Francisco—333 Montgomery St.; Los Angeles—4800 District Blvd.; Portland—520 S. W. Sixth Ave.; Salt Lake City—73 S. Main St.; Seattle—821 Second Ave.

For more information on Tenamene additives and the service that backs up their proper use, contact our local representative or write to Eastman Chemical Products, Inc., Kingsport, Tennessee—a subsidiary of Eastman Kodak Company.

Rockwell-Nordstrom
LUBRICANT

Rockwell-Nordstrom Valves Prove Lubrication Is The Cheapest Maintenance!

● LUBRICATION ELIMINATES METAL-TO-METAL FRICTION

—the major source of valve wear. As in your automobile engine, lubrication assures longer life and better performance. Pressurized lubricant also forms a remarkably leakproof seal between the plug and the valve body. This lubricant seal has proven far more effective than the uncertain metal-to-metal seal in ordinary valves where a tiny scratch means leakage . . . and eventually, expensive reseating.

Costly valve down time is practically eliminated with Rockwell-Nordstrom valves because lubrication stops trouble before it starts. The lubricant also hydraulically jacks the plug to eliminate stuck or jammed valves, assures *instant*, quarter turn operation.

● LUBRICATION IS FAST...EASY

Rockwell-Nordstrom valves can be lubricated either with a pressure gun directly through the standard Rockwell fitting or by unscrewing the fitting and inserting lubricant "sticks." Lubrication never requires valve down time because any Rockwell-Nordstrom valve can be lubricated under service pressure.

Like any lubricated mechanism, frequency of use and operating conditions are the determining factors in the lubrication schedule. In any case, the time it takes to lubricate a Rockwell-Nordstrom valve is an investment in trouble-free, long-life valve service.

● LUBRICATION PENNIES SAVE MAINTENANCE DOLLARS

A few cents worth of lubricant buys three things: 1. *new seats* (renewing the lubricant is like reseating an ordinary valve) . . . 2. *smooth, dependable operation* and . . . 3. *savings* in terms of lower repair, replacement and down time expenses. It is not the cost of the lubricant that is important, but the *savings* through longer, more dependable life of the working parts and better performance.

● GENUINE ROCKWELL-NORDSTROM LUBRICANTS are specially compounded to not only reduce friction, but also to create a positive, leakproof seal. They are the result of 40 years of production "know-how" and field testing by the pioneer lubricated plug valve manufacturer. Their sole purpose is to insure that Rockwell-Nordstrom valves give you the best valve service you've ever had. That's why it's good business to use *only* genuine Rockwell-Nordstrom lubricants in Rockwell-Nordstrom valves.

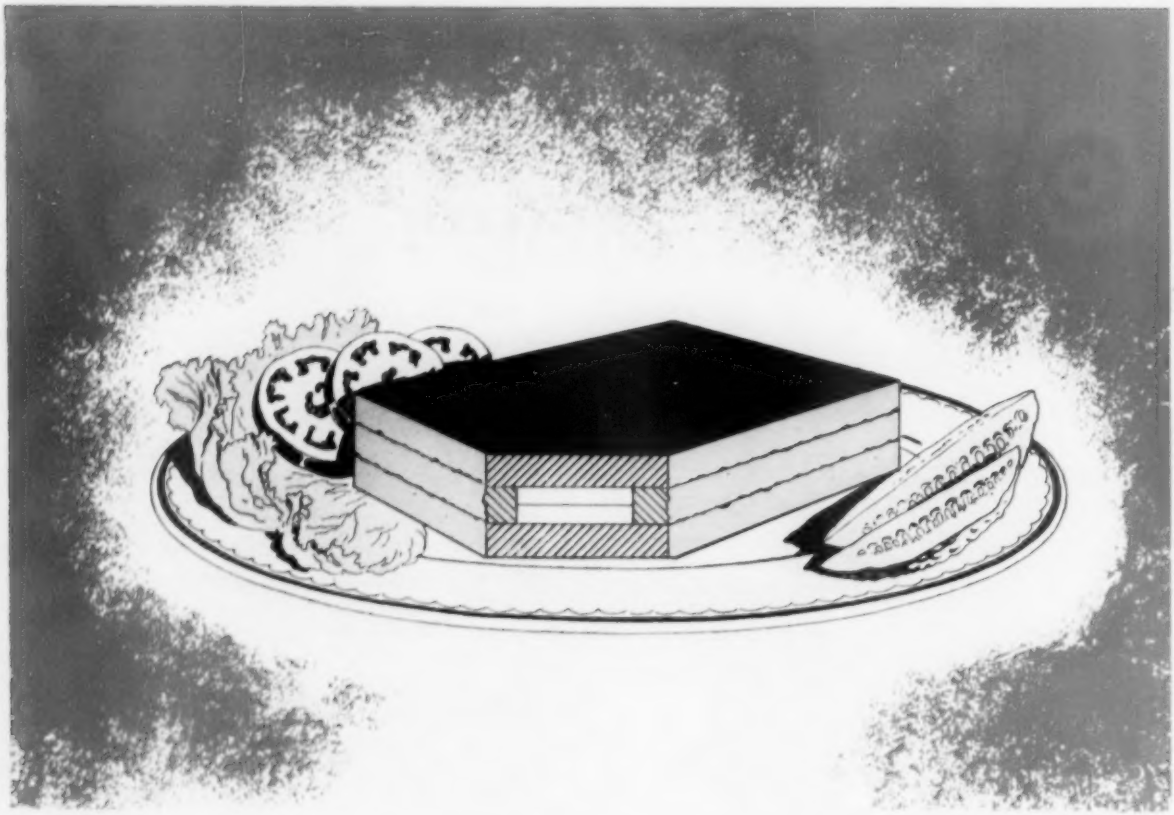
● 40 YEARS OF PERFORMANCE PROVE that Rockwell-Nordstrom valves are the most economical valves you can buy for *any* service. Over the years, the sale of repair parts has been less than one-half of one per cent of Rockwell-Nordstrom valve total valve sales . . . *for every two dollars users spend on Rockwell-Nordstrom valves, they spend less than one penny for repairs.*

Whatever your needs, there is a Rockwell-Nordstrom valve that will do the job with more trouble-free dependability and at lower cost per year than any other valve you've ever used. And the first cost of Rockwell-Nordstrom valves is no more (and often less) than the cost of ordinary valves! For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF



here's the sandwich that saves you money*

*
As you know, a "sandwich" is merely the unit, consisting of two stainless plates between two carbon or alloy steel plates, which is assembled and rolled into stainless-clad plates.

When you buy *this* sandwich, you get all the benefits of solid stainless steel—for less cost.

Claymont Stainless-Clad Steel Plates give you all the corrosion and contamination resistance of stainless steel where protection is needed, and the economy of carbon steel where strength is required. You can specify the cladding in any percentage your process requires—from 5% to 50% of the total plate thickness.

So if you fabricate or use equipment where product contamination or corrosion is a problem—if you are looking for stainless steel protection at lower cost—you can use Claymont Stainless-Clad Steel Plates to good advantage. For full details, contact the nearest sales office shown below, or write direct to Wickwire Spencer Steel Division, The Colorado Fuel and Iron Corporation, P.O. Box 1951, Wilmington, Delaware.

CF&I **Claymont Steel Products**

3537

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Carbon and Alloy Steel Plates - Flanged and Dished Heads - Manhole Fittings and Covers - Large Diameter Welded Steel Pipe - Flame Cut Steel Plate Shapes - CF&I Lectro-Clad Nickel Plated Steel

We send you best wishes
for a Happy Holiday Season
from our Houston Headquarters.

SCHLUMBERGER
Well Surveying Corporation
THE EYES OF THE OIL INDUSTRY

Fahey Flynn asks:

SHOULD BUSINESS HELP SUPPORT OUR COLLEGES ?

FAHEY FLYNN, well-known radio and television newscaster. WBBM, WBBM-TV, CBS, Chicago

DR. LAURENCE M. GOULD, president of Carleton College, Northfield, Minnesota:

"Education has been described as the 'cutting edge of progress.' The phrase aptly shows the interdependence of business and education. Far-sighted businessmen already have seen the danger signs in rising educational costs and are doing something about it. The financial aid of organizations like Standard Oil has helped greatly to avert what might become a major crisis in education."

DR. FRANK H. SPARKS, president of the Associated Colleges of Indiana and president of Wabash College, Crawfordsville, Indiana:

"Almost everyone agrees that it is to the advantage of business, education, and the state that the privately-financed colleges of America remain independent and strong. Since privately-financed education and privately-financed enterprise have a common stake, contributions to colleges are sound, long-range investments for any business. Standard Oil has done great service to America in recognition and support of this principle."

HAROLD A. LINDAHL, graduate student, Illinois Institute of Technology, Chicago, Illinois:

"The great shortage of scientists and engineers is one of America's most serious problems. Fortunately, some companies have started to correct this situation by giving financial help and encouragement to students who are studying for such careers. In my own case, a Standard Oil Foundation fellowship has made it possible for me to study for my doctorate in chemical engineering at Illinois Tech."

RALPH F. KRAUSE, JR., senior at Grinnell College, Grinnell, Iowa:

"Large companies like Standard Oil rightly have taken an interest in education. Students often find it difficult to earn enough to meet their many college expenses and still devote enough time to studying. Scholarship grants, such as the one I have received from Standard Oil Foundation, permit a student to concentrate on the business of learning."

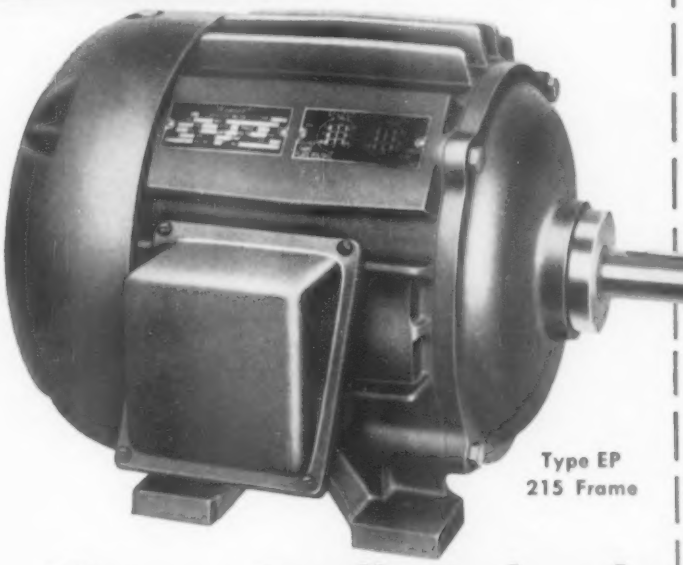
Financial aid to our colleges and a helping hand to serious and able youngsters serve to keep America strong and free. That is why we of Standard Oil believe very definitely that business *should* help support our colleges. Thirty-seven graduate and undergraduate college and university students are studying under Standard Oil Foundation fellowships and scholarships. Selection of all students receiving such individual awards is made by the colleges. The Standard Oil Foundation also has set up a yearly grant of $150,000 to aid privately-financed liberal arts colleges through their state associations in Midwestern states.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

New NEMA Frames
Standard and Explosion-proof



Type EP
215 Frame

Wagner Totally-Enclosed Fan-Cooled Motors

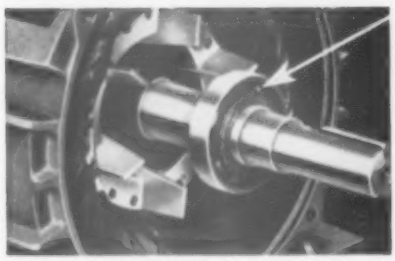
cut maintenance time and costs

Check the features of the new *Wagner Type EP Totally Enclosed Motor*. They spell the difference between needless expenditures in maintenance time and costs . . . and a definite savings in motor upkeep and repairs. You'll find that for general industrial use where dust, dirt, filings, abrasives, steel chips or moisture are present, the Wagner Type EP Motor gives steady, troublefree performance and longer service life.

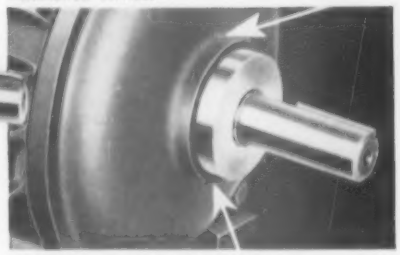
Wagner Type JP Explosion-Proof Motor . . . has the same quality construction as the Type EP — plus added features which make it completely safe to operate where explosive dust, gases or vapors are present.

Both Type EP and JP Wagner motors are available in ratings up to 250 horsepower. For complete information, just call the nearest of our 32 branch offices, or write for Bulletin MU-203.

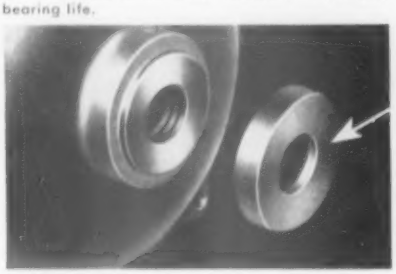
Wagner Electric Corporation
6389 Plymouth Ave., St. Louis 14, Mo.



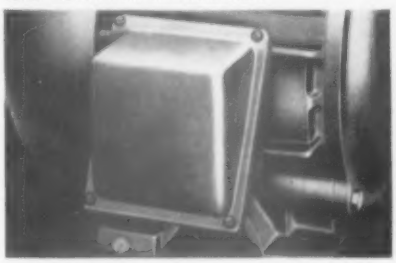
1 HEAVY-DUTY BALL BEARINGS—Highest quality bearings of more than ample capacity provide long, troublefree service.



2 BEARINGS CAN BE RE-LUBRICATED—Wagner motors can be re-lubricated when necessary to prolong bearing life.



3 BEARINGS STAY CLEAN—Both ends of these motors are equipped with running shaft seals, a machined collar mounted on the motor shaft.



4 EASY TO CONNECT—Large diagonally-split conduit box provides ample room for making connections. Leads are permanently identified.

5 NO GREASE LOSS—Bearing housings have effective seals to prevent escape of grease.

6 RIBBED FRAME—Ribs on the corrosion resistant cast iron frames add mechanical strength and increase the surface area for more efficient cooling.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

M55-18

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

a 20-year project lets you

SET IT and FORGET IT

advances in MM engine design keep pace with oil industry's greater performance demands

To *set* power and *forget* it demands superior on-the-job serviceability *and* service.

Minneapolis-Moline *serviceability* means super long-run dependability . . . a 20-year improvement project that has kept pace with stepped-up performance requirements of the oil industry.

Months and years of continuous unattended operation on oil field pumping jobs attest to the success of MM's exclusive maintenance-saving design. Part size, weight and displacement of MM engines increases with h.p. Cylinder blocks and heads are cast in removable pairs separate from the crankcase to simplify service and renewal. Crankcases have extra depth below center line of crankshaft for greater rigidity and bearing support, offer metered vacuum ventilation for longer lube oil life. Thermo-clad protection with bypass cooling and water-blanketed base pans provide complete temperature control.

In addition to MM long-run advantages, you cut operating costs with SECO flat-rate contract maintenance. Compare this SECO flat-rate service contract with your present service charges for hourly pay, mileage, etc., and see how maintenance costs go down. Exclusive MM SECO service by Shrimpton offers a complete engineering, installation and maintenance program that means you can literally "set it and forget it". Discover the big, two-way savings you can make with long-run MM engines serviced by SECO. Contact your MM oilfield distributor for the facts.

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MINNEAPOLIS MOLINE
MODERN MACHINERY
DIVISION

MINNEAPOLIS-MOLINE
MINNEAPOLIS 1, MINNESOTA

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The Nation's Leading Builder and Converter of Waterborne L.P. Gas and Ammonia Vessels

S.S. Natalie Warren, converted to L.P. Gas Carrier. Water capacity 38,000 barrels.

S.S. Ultragaz, converted to L.P. Gas Carrier. Water capacity 17,100 barrels.

Ammonia Mariner, seagoing Anhydrous Ammonia Barge. Water capacity 721,270 gallons.

Esso Viru, oceangoing L.P. Gas Barge. Water capacity 220,000 gallons.

Panama City, rivergoing L.P. Gas Barge. Water capacity 393,000 gallons.

Port Everglades, oceangoing L.P. Gas Barge. Water capacity 550,000 gallons.

These craft are indicative of Bethlehem's activities in the construction and conversion of specialized vessels for the economical and dependable waterborne transportation of L.P. Gas and Anhydrous Ammonia. If you have a problem involving the shipment of these or other petro-chemical products, we may be able to help you. Your inquiries will receive prompt attention.

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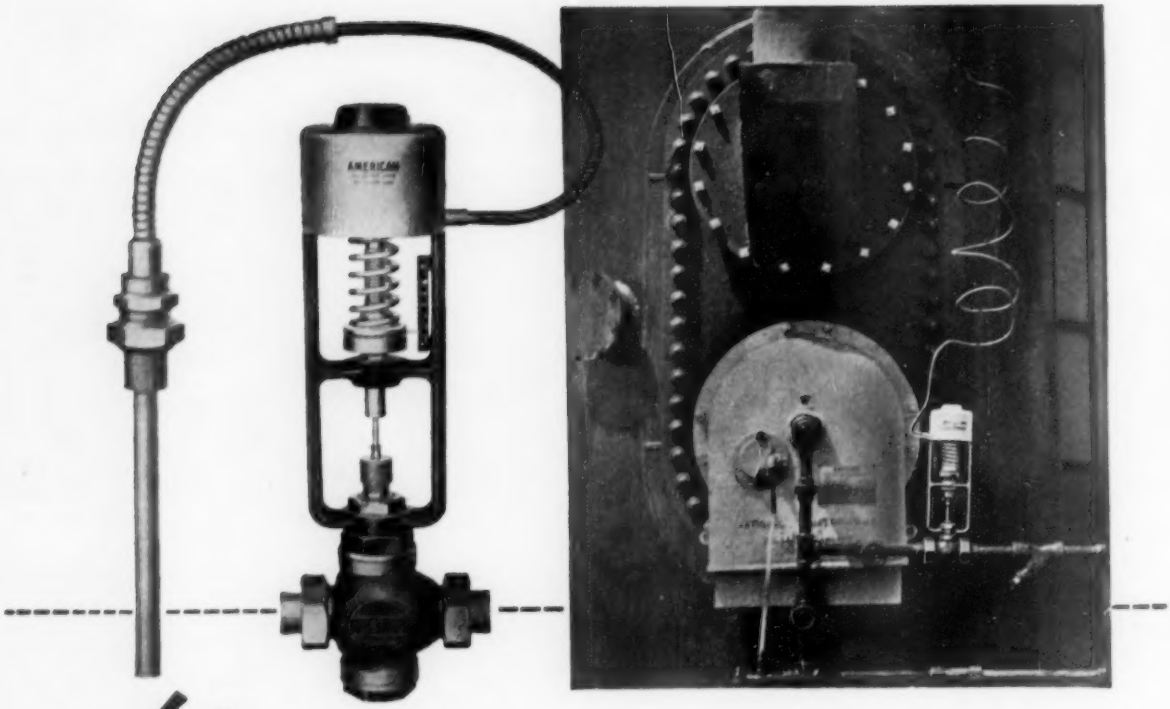
BETHLEHEM STEEL

Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation



You SELECT THE TEMPERATURE...

the American Temperature Regulator maintains it constantly

Your convenience is suited by the ease with which you can select and maintain required temperatures when you use American Temperature Regulators. The sensitivity and responsiveness built into these fine products through long years of engineering and manufacturing experience combine to assure accuracy of temperature control.

Day after day, these compact, easy-to-install and durable regulators provide dollar savings by maintaining temperature within required limits. Securely housed in indoor plants or withstanding the elements in field installations, American Temperature Regulators serve industry dependably wherever temperature control means dollar savings.

Among the many applications where American Temperature Regulators are giving good account of themselves daily are crude oil heaters and treaters and other process equipment; hot water tanks and diesel water jackets; feedwater systems and air compressor after coolers.

Installation, temperature adjustment and repeat setting are easy. Sizes range from ¼" to 4". Protective armor safeguards the capillary tubing and a heavy steel cap protects the seamless bellows against damage. A safety spring protects the bellows from damage caused by accidental overheating of the bulb.

Increase efficiency and cut costs—get constant, safe, dependable temperature control of oil, water, steam, and other media. Put the rugged American Temperature Regulator to work for you 24 hours a day. Complete information is yours on request. Write for Bulletin 112.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. Buy conveniently and economically—call on him for expert counsel and prompt delivery from local stocks.

AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' AND 'AMERICAN-MICROSEN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, AIRCRAFT PRODUCTS. BUILDERS OF "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

Here is EXTRA MOTOR VALUE

Double-shielded bearing
Large grease reservoirs
Bolted-on bearing cap
Labyrinth seals

This Allis-Chalmers Bearing Design Gives More for Your Motor Dollar

You can lubricate these bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and relieving pressure during re-greasing.

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, minimizes the possibility of grease entering the interior of the motor . . . retains an ample supply within the bearing enclosure.

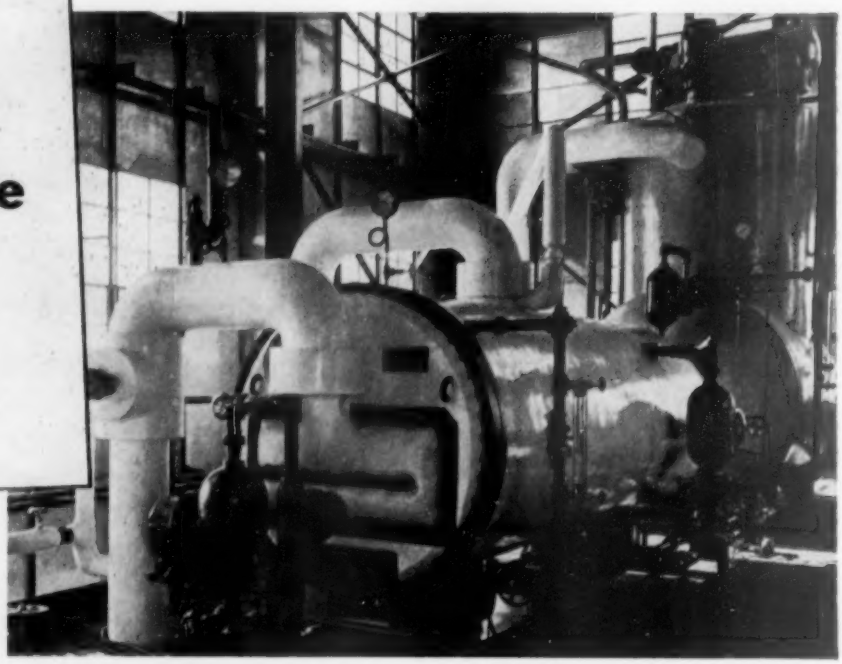
At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt barriers.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to give you the facts on this maintenance-saving design. Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin, for Bulletin 51B7286. A-4855

ALLIS-CHALMERS

Important!

if you have a moderate size boiler plant



Evaporators for eliminating the impurities from boiler feed make-up were originally developed for large power generating stations.

However, the results obtained with G-R Type R Horizontal and Type H Vertical Bentube Evaporators in industrial plants all over the country have proved that *moderate size plants* can also frequently profit by the many benefits of distilling the raw water supply.

This is a possibility well worth your investigation. Boiler feed purification by G-R Evaporators does not involve the use of chemicals nor require periodical water tests or manipulation by skilled operators. Moreover, it is the simplest method of eliminating raw water impurities.

Write for complete information.

G-R Type R and Type H Evaporators are adaptations of the larger Type J-2 Bentube Evaporator—widely used by central power generating stations. They embody the exclusive scale-shedding G-R Bentube heating elements, and have many additional distinctive G-R features that assure ample capacity, pure dry vapor, long service, low maintenance expense and convenient attendance.

THE GRISCOM-RUSSELL CO.
MASSILLON, OHIO
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

G-R HEAT TRANSFER APPARATUS **Bentube Evaporators**

A STEEL STOP VALVE on which YOU CAN STANDARDIZE

DELIVERIES FROM STOCK

It's no longer necessary to buy a different type of forged steel stop valve for every different service. Here's a valve on which you can standardize—one that fits 90 per cent of normal services where forged steel stop valves are used.

Built in globe and angle designs, from ¼ in. to 1 in. sizes, with screwed or socket welding ends. Deliveries can ordinarily be made from factory stocks

Fig. 2698—Globe, inside screw, 600 lb sp.

Fig. 2699—Angle, inside screw, 600 lb sp.

Similar design, O.S.&Y. type, also carried in stock.

For design and dimensional details on these and other Edward steel valves, write for Catalog No. 105.

These Features Save you Money!

1. Low Pressure Drop — You can use smaller pipe sizes.
2. EValloy Stainless Steel Seats and Disks Borized in Mated Pairs.
3. EValized Bonnet—Wear Resistant Threads.
4. Centerless Ground Stem—Long packing life.
5. Easy Packing Adjustment.
6. Oversize Handwheel—Easy Operation.
7. Forged Steel Bodies and Bonnets.

Another Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY
1212 W. 145th STREET
EAST CHICAGO, INDIANA

Applying long-term pipeline protection

Quickly and Easily

Wrapping 8" and 10" Lake Country Gas Company natural gas line with Trantex Tape using Tapester wrapping machine. Line will serve the outlying commuter area of Cleveland. Trantex was used primarily because soil was extremely corrosive. Line was several miles in length.

J-M Trantex Tape is cold-applied, sticks on contact, bonds to enamel

Trantex® is recommended for

- Gas distribution systems
- Pipe lines through difficult terrain
- Field joints of mill-coated and wrapped pipe
- Transmission pipe lines
- Overhead piping

For further information,
write to Johns-Manville, Box 60, New York 16, N. Y.; in Canada, 565 Lakeshore Road East, Port Credit, Ontario.

Wherever pipe lines require a long-lasting, corrosion-defying protective material . . . and easy, quick application is important . . . Trantex Tape is ideal. This pipe line coating can be applied by hand or with simple wrapping devices. No need for heavy-duty equipment or trained personnel. Trantex Tape sticks on contact, forms a firm, stable bond on either pipe or enamel . . . conforms to irregular surfaces.

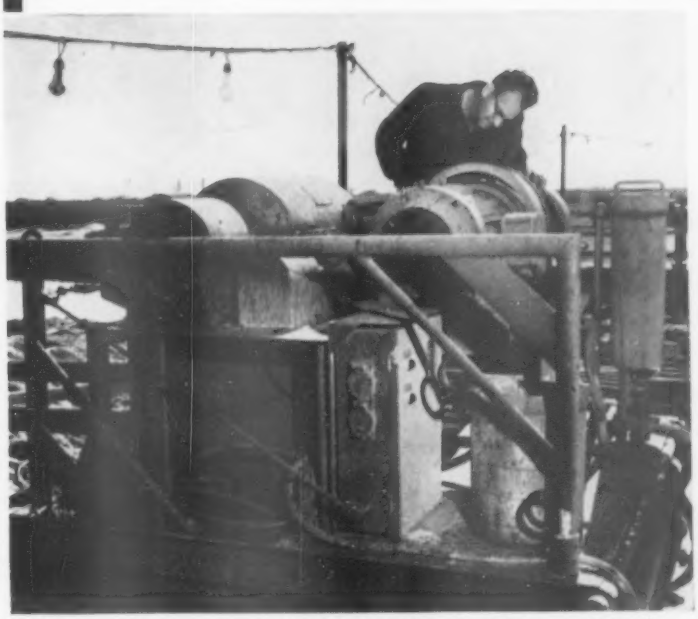
In addition to on-the-job application, Trantex Tape is widely used on field-welded joints of mill-wrapped pipe to provide corrosion protection at these critical points.

Johns-Manville TRANTEX *polyvinyl* TAPE

PROTECTS PIPELINES AGAINST CORROSION

Thanks to Gýrol Fluid Drive—

HOMCO's "Mud-Miser" electrical circuit is simplified



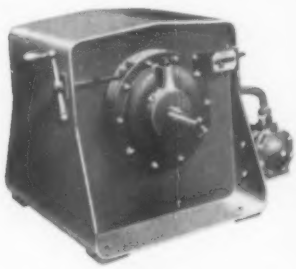
Unretouched photo shows HOMCO Mud-Miser installed near Rayne, La.

The "Mud-Miser" is a new application of the "Sharples" decanting-type centrifuge, developed by the Houston Oil Field Material Company, Inc., Houston, Texas. It is a compact unit, designed to separate and remove drilled solids from mud used in oil-drilling operations.

"Because of high starting torque, and to allow adjustable speed between 1800 rpm and 3200 rpm," states T. G. Bergey, HOMCO's division manager, "the normal electrical equipment would be bulky.

"The installation of a Gýrol Fluid Drive between the motor and the centrifuge eliminated the need for complicated electrical across-the-line starting equipment, and permitted simple speed adjustment.

"By allowing the 15-hp motor to reach approximately 90% of full speed before the load is automatically picked up, the starting-current load is reduced to the point where ordinary overload-protected starting equipment has proved adequate."



Type VS, Class-2, adjustable speed Gýrol Fluid Drive. Speed range: 5 to 1. Six sizes, 7½ to 800 hp; speeds to 1800 rpm.

Fluid Drive Only Way

"We feel that Gýrol Fluid Drive is the only means we can use for safe, sure, adjustable power transmission between prime mover and rotating members," concluded Mr. Bergey. Ask your nearest American Blower Branch Office for data on how Gýrol Fluid Drives can ease *your* power transmission problem.

Gýrol Fluid Drive is located between motor and centrifuge on Mud-Miser.

American Blower products serve industry

- AIR CONDITIONING, HEATING, VENTILATING EQUIPMENT
- MECHANICAL DRAFT EQUIPMENT
- INDUSTRIAL FANS AND BLOWERS
- CENTRIFUGAL COMPRESSORS
- GÝROL FLUID DRIVES
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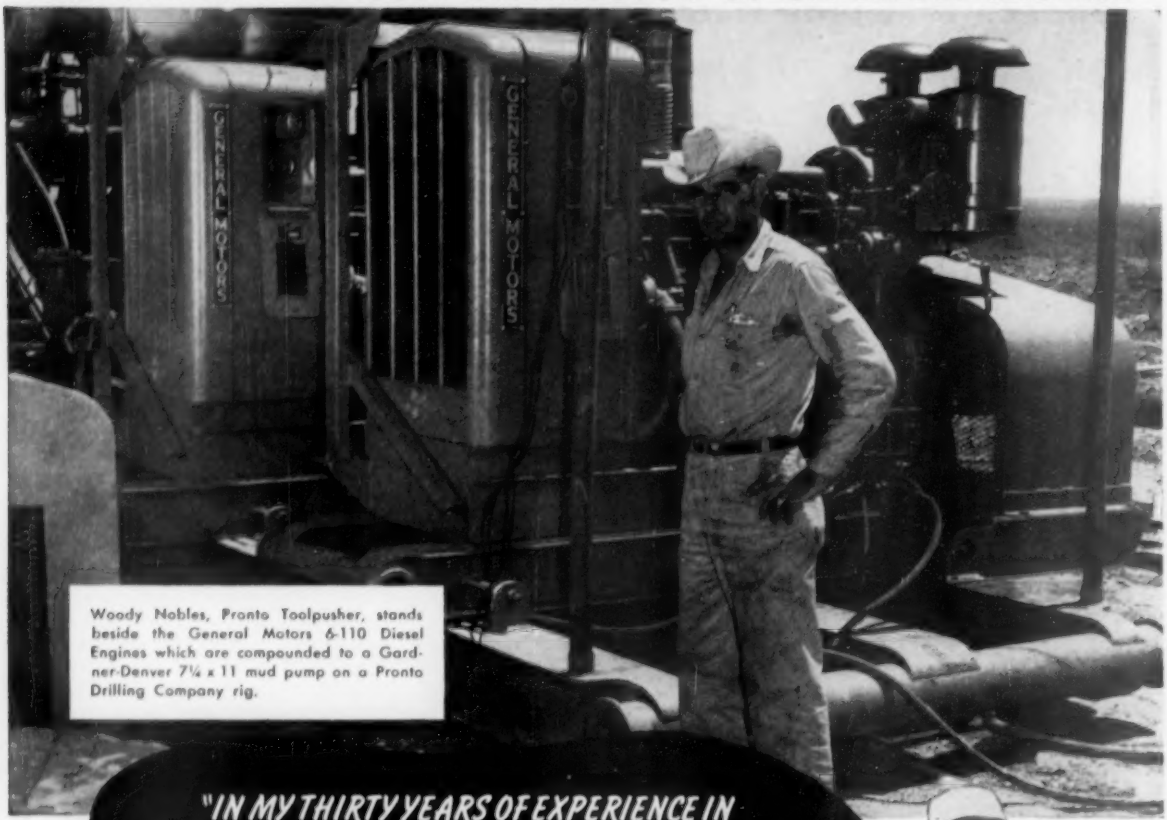
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

HERE'S ANOTHER REASON WHY STEWART & STEVENSON IS THE NATION'S LARGEST DISTRIBUTOR OF GM DIESEL ENGINES



Woody Nobles, Pronto Toolpusher, stands beside the General Motors 6-110 Diesel Engines which are compounded to a Gardner-Denver 7¼ x 11 mud pump on a Pronto Drilling Company rig.

"IN MY THIRTY YEARS OF EXPERIENCE IN THE OILFIELD, I HAVE NEVER SEEN SERVICE AS GOOD AS THAT OF STEWART & STEVENSON" - LEE MINTON, PRONTO DRILLING COMPANY

Nearly four years ago, Pronto Drilling Company powered this Emsco GA-250 with General Motors Diesel Engines from Stewart & Stevenson, including the auxiliary pumps and light plants. During the life of the rig, it has drilled an unusual number of wells (more than 300,000 feet) with a minimum of down-time. Lee Minton gives much of the credit for his low down-time record to the excellent service from Stewart & Stevenson branches.

Service to the customer is the rule we live by at Stewart & Stevenson Services . . . because we feel that engines are only as good as the parts and service organizations behind them. Good service is just one reason why Stewart & Stevenson is the Nation's largest distributor of GM Diesel Engines. Here is another: Stewart & Stevenson has the greatest backlog of experience in engineering, more different types of diesel and gas engine applications than any other engine distributor. When you need any kind of oilfield power, call Stewart & Stevenson. There's a branch less than two hours from your operations.

STEWART & STEVENSON SERVICES, INC.

CHRYSLER GM Built Units Climax

Main Office and Plant:	4516 Harrisburg Blvd., Houston 11, Texas. Phone Phone CA 5-5341
Branches:	Corpus Christi, Dallas, Lubbock, Wichita Falls, San Juan, Odessa.
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Distributors of:	General Motors Diesel Engines, Climax Blue Streak Engines, Chrysler Industrial and Marine Engines, Petter Diesel Engines.
Fabricators of:	Electric Power Units, Electrical Control Equipment, Portable Pumping Units, Red Head Pumps.

STEWART & STEVENSON

THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

Texas oil companies prove the value of split channel radio operation

G-E narrow band equipment serves Loffland Brothers, Standard of Texas, and Seaboard Oil Company

In the Texas oil fields they'll tell you that *practical* split channel radio operation is proving its worth right now. Two major oil companies and a major drilling contractor, operating in an area pointing north from Odessa to Vealmoor and Snyder, have cooperated in establishing three independently operated systems in a range that formerly served two firms.

Rather than share a channel when Loffland installed radio in the area covered by Standard's 48.74 MC frequency and Seaboard's 48.78 MC allocation, the three firms decided to work on an experimental split channel basis. Slight modification of G-E equipment in use narrowed the spacing from 40 KC to 20 KC, permitting Loffland Brothers' new General Electric radios to go on the air on 48.76 MC.

Clear channels for all

Now, each firm operates on its own frequency, without interference from either of the others. Because of split channel operation and General Electric narrow-band radio equipment, three companies benefit from 2-way radio communications without interference to one another.

The new G-E Progress Line of 2-way radio equipment provides a complete interchangeable package. Transmitter, receiver, power supply, and optional chassis are individually rack-mounted. Plug-in design permits quick changes of frequency, power, or type of reception.

2-WAY MOBILE RADIO

Your General Electric Communications Counselor will be pleased to cooperate with you in planning a split channel operation for your company. Call him in, or write today to: *Section X8125-5, General Electric Company, Communication Equipment, Electronics Park, Syracuse, New York.*

RADIO ANTENNA CAPS LOFFLAND BROTHERS' RIG near Odessa, Texas. Nine General Electric base stations and mobile radio units have cut $400 per month from former telephone costs.

STANDARD OIL OF TEXAS operates two G-E 60-watt base stations linking seven mobile units with the main base at Snyder, Texas. Radio speeds orders, makes instant decisions possible for fast action.

SEABOARD OIL COMPANY maintains instant operational contact with field locations through 5 G-E base stations. 20 mobile units coordinate widespread drill site activities in the West Texas area.

Progress Is Our Most Important Product

GENERAL ELECTRIC

The Payroll AUDITOR . . . . . .

His Job–to Help You Save Money

The TEIA Auditor's job is to help provide the best possible Workmen's Compensation Insurance service and help you SAVE money.

He periodically checks with policyholders to make sure that workers are covered under the proper classifications and that the policyholder is paying no more than he is supposed to pay for his coverage.

Yes, the Payroll Auditor is a part of the TEIA SERVICE TEAM and it's his job to help you SAVE money.

MILLIONS OF DOLLARS
Saved and Returned to
POLICYHOLDERS *by*
TEXAS' *Largest Writer of*
WORKMEN'S COMPENSATION

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*

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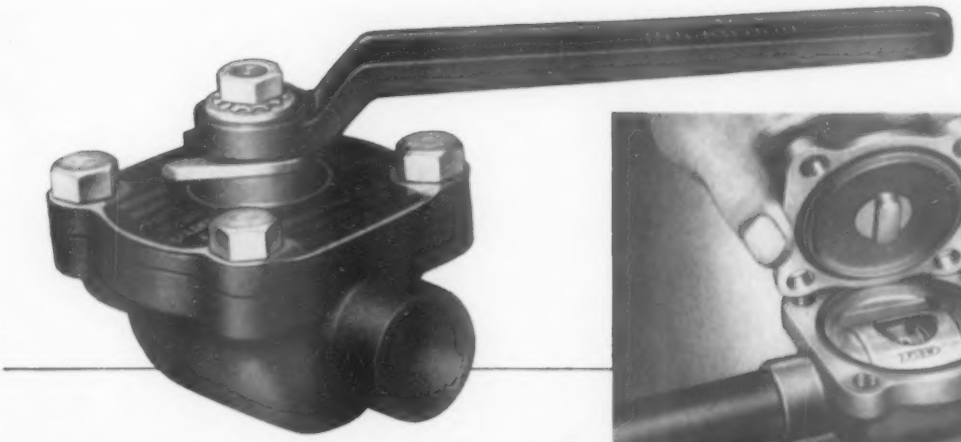
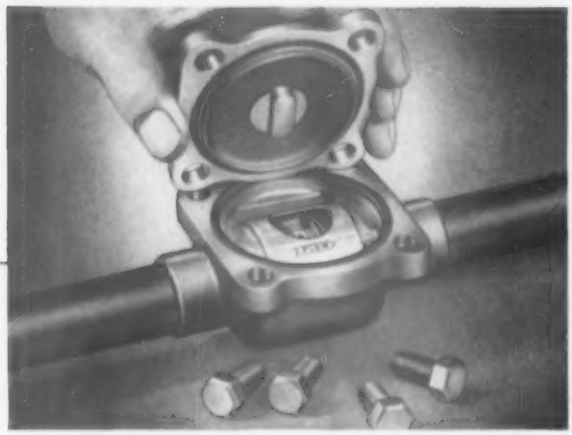
TEXAS EMPLOYERS INSURANCE ASSOCIATION
HOME OFFICE · DALLAS, TEXAS





FAST, LOW-COST CHANGE IN DIRECTION OF FLOW. Removal of the body cap permits reversing the cage assembly to allow change in direction of flow. In addition, this feature lets you change seat material, and clean the valves thoroughly and quickly — *without removing the valve from the line!*

INTERCHANGEABILITY of seat material to meet your operating requirements is another feature of the Rockwood Top Entry Ball Valve. Seat can be furnished in Buna-N, Neoprene, Kel-F, Teflon, and Nylon.

EASY INSTALLATION AND OPERATION is permitted because of the new handle design. This new design allows the handle to be placed in any of *eight positions!*

Now!... New Rockwood Top Entry Ball Valve

. . . A new concept in valves that saves you money and time!

Made of bronze the new Rockwood Top Entry Ball Valve is ideal for handling oxygen and hazardous liquids as well as water, oil and gas. It carries 300 lbs. per square inch on water, oil and gas and 400 lbs. per square inch on LP gas and is available both with sweat ends and screw ends, in sizes ½", ¾" and 1".

Write for complete data on this unique full round pipe size flow.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

Distributors in all Principal Industrial Areas

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY
767 Harlow Street
Worcester 5, Mass.

Please send me complete information on Rockwood Top Entry Ball Valves.

Name .....

Title .....

Company .....

City .....

Zone ..... State .....

TAKE A TIP

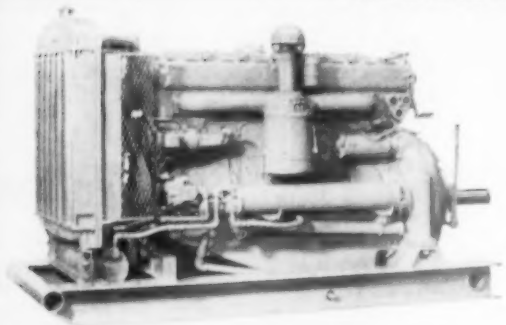
from successful Rocky Mountain drilling contractors

Two 225 H. P. Murphy Diesels power the drawworks and pump on this rig owned by Grannell Drilling Company and operating at Cut Bank, Montana.

Get the economy and dependability that only MURPHY DIESEL can give you

What do you need in power? Real working power that you can depend on? Power that makes the most hole with the least fuel cost? You get both with heavy duty Murphy Diesels. They're designed and built to deliver the kind of power a driller needs—dependable and low cost. The proof is in the drilling records of contractors everywhere. Ask your Murphy Diesel Dealer to give you full information and show you how Murphy Diesel Power will fit into your drilling picture.

MURPHY DIESEL COMPANY
5305 W. Burnham St., Milwaukee 14, Wisconsin



Murphy Diesel Engines and Power Units are available in sizes from 96 to 264 H.P.; Dual-Fuel Engines and Power Units from 144 to 230 H.P.; generator sets from 64 to 165 K.W.

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MURPHY DIESEL

SEE YOUR MURPHY DIESEL DEALER, TODAY—

ALBUQUERQUE, NEW MEXICO, Lively Equipment Company; BUTTE, MONTANA, Hall-Perry Machinery Company; CORPUS CHRISTI, TEXAS, Houston Engine & Pump Company; DALLAS, TEXAS, Conley-Lott Machinery Co.; DENVER, COLORADO, Macdonald Equipment Co., Inc.; EDMONTON, ALBERTA, CANADA, Northern Engine & Equipment Co., Ltd.; GREAT BEND, KANSAS, Manufacturers Supply Inc., E. 10th St., P. O. Box 484; GREAT FALLS, MONTANA, Hall-Perry Machinery Company; HOUSTON, TEXAS, Houston Engine & Pump Co., Inc.; JACKSON, MICHIGAN, Utility & Industrial Supply Co.; LOS ANGELES, CALIFORNIA, Industrial Engine Service; LUBBOCK, TEXAS, Conley-Lott Machinery Co.; SAN ANTONIO, TEXAS, The Roy Klossner Company; BAKERSFIELD, CALIFORNIA, Glenn Rose Engine Service; ODESSA, TEXAS, Conley-Lott Machinery Co., ODESSA, TEXAS, Harries Sales & Rental, P. O. Box 1568; LONGVIEW, TEXAS, Conley-Lott-Nichols Machinery Co.

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The clean, functional design of PARKERSBURG Steel Buildings compliments the architecture of any industrial or residential area. But that is only part of the picture.

Their sturdy steel framework and interlocking side panels give them more than enough strength to take whatever the elements offer — and provide years and years of security for whatever they house. The original structure can be expanded to meet future requirements simply by the addition of standard units at low cost. They can be individualized or visually enhanced with special fronts. They require practically no maintenance . . . are quickly erected . . . and can be moved with 100% salvage.

- *Let the PARKERSBURG representative show you how you get more — far more — for your building dollars with PARKERSBURG Steel Buildings.*

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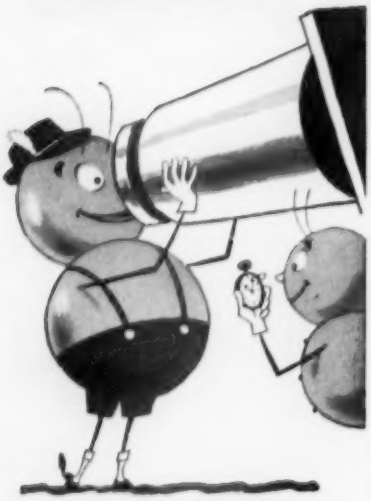
SOAKS UP MOISTURE TWICE AS FAST!



Use Sovabead in your dehydrator!

- It nearly doubles dehydrator efficiency.
- Maintains efficiency at temperatures as high as 120°F.
- Provides longer desiccant bed life.
- Eliminates caking, reduces channeling, dusting and pressure drops.

Ask Your Representative About Sovabead

Process Products

MOBIL

Process Products

SOCONY MOBIL OIL COMPANY, INC.
26 Broadway, New York 4, N. Y., and Affiliates:
MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.
Formerly Socony-Vacuum Oil Company, Inc.

They Say—

Running Out of Oil?

"The industry hasn't found any really big fields like East Texas in recent years. However, many of the fields that we're finding today are similar in structure to East Texas, so it's possible that large fields of this type might be found in the future.

"But the fact that we annually find more new oil than we produce is indicative of an intensive exploration program — one that is successful, even though individual pools may be smaller."

Edgar F. Bullard, president of Stanolind Oil & Gas Co., in an interview in "Standard Torch," Standard of Indiana publication.

The Air Force and Oil

"Let me give you some idea of what's consumed in the Air Force.

"To begin with, we are buying just about three-quarters of a billion dollars worth of fuel this year . . . .

"What does this kind of money buy?

"In 1955, it paid for almost 30 million barrels of high octane aviation gasoline and another 15 million barrels of lower octane aviation gasoline. It also paid for over 65 million barrels of jet fuel . . . .

"In spite of the increased use of jet engines, our demands for high octane aviation gasoline have continued to rise. We expect that we will continue to buy high octane fuel at a high rate for the next several years.

"Actually we have trouble getting as much of the best grade of gasoline as we want. The better the gasoline the better the performance of our piston engines—and we have many piston engine airplanes. The bulk of our transports and our tankers will be piston powered for a long time.

"For this reason, I would encourage the oil industry to push the manufacture of alkylate. That is reported to be the main bottleneck in the production of the very high octane fuel we need in modern engines.

"We also are searching for improved fuels for our jet engines. Recent research has indicated that great improvements in jet fuels are attainable. These improvements consist of making the fuel hotter, or, as you oilmen say, more

Hold Tight!

Get a Better Grip on Your Work with PROTO Professional-Quality Pliers

Sensational "Multi-Plier" multiplies your gripping power 10 times!

There's no substitute for the *right* plier when you need it. Choose exactly the ones you need from the huge PROTO line — standards, midgets, side cutters, end nippers, slip-joint and special purpose pliers—all made from fine steels. You'll get powerful leverage, and comfortable, positive-grip handles. Buy the ones you need from your PROTO Dealer! Send 10¢ for catalog of entire line to

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Try Comfortable PROTO *Handeze* Plier Grips

More hand comfort with replaceable, colorful vinyl plastic grips! Three sizes fit most pliers. Many PROTO Pliers already equipped. See your dealer today!

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PROTO means PROfessional TOols

Eastern Factory, Jamestown, N. Y. • Canadian Factory, London, Ont.

INTRODUCING

Magcobar G-7 SUPER-WEIGHT

The Oil Industry's First Field-Proved Weighting Material for Making 30 lb. Mud

for extreme high pressures or emergency use only
G-7
SUPER-WEIGHT
FOR MAKING 30#/GAL. MUD TO USE IN THE CONTROL OF HIGH PRESSURE EMERGENCIES
Magcobar

For the first time, a **field-proved** 30 lbs./gal. mud is available to the oil industry! This mud, Magcobar G-7 Super-Weight, was first used successfully nearly a year ago to control extremely high subsurface pressures under emergency conditions. Since that time other extremely high pressure wells have been successfully controlled with Magcobar G-7.

Magcobar G-7 Super-Weight is a finely ground product with an unusually high specific gravity (7.0) and is suited for preparation of extremely high weight muds in the range of 26-32 lbs./gal. It has a particle size of 70% through 325 mesh. It is a charcoal colored free-flowing powder which is easily mixed through a jet hopper mixer.

G-7 Super-Weight muds can be used under these or similar conditions:

a. Working over high pressure wells, in which tubing or casing failure has occurred relatively near the surface.

b. Emergency situations in drilling wells, where a critical mud weight balance exists between an upper loss zone and a lower high pressure zone.

c. Blow-out wells, in which the normal blow-out prevention procedures have failed or are not economically practical.

The preparation of special high weight muds with Magcobar G-7 requires considerable care in that a balance between support of weighting material and viscosity for pumpability must be maintained through the correct quantity of low gravity solids.

MAGCOBAR G-7 IS NOT RECOMMENDED FOR USE IN THE NORMAL DRILLING OPERATION. If you have an emergency drilling condition that cannot be safely controlled with regular 20 lbs./gal. Magcobar muds, it is recommended that you contact your Magcobar field engineer for specific study and recommendations for your problem. A stock of Magcobar G-7 is maintained at New Orleans, Louisiana, and is available from this stock through all Magcobar dealers.

Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

HOUSTON, TEXAS

There's a better, easier way to pump oil wells, too...

Tackle an old problem in a new way and frequently you find it tremendously simplified. This is certainly the case with the Kobe *Free Pump* System of oil well pumping... some producers have found it easier to *Free Pump* wells than to flow them. As can be imagined, major economies result. The Kobe system frequently costs $2,000 to $4,000 per well less to install and 50% less to operate. If you are interested in such savings, why not drop us a line?

Our pictorial magazine, Pumping Trends, shows how KOBE is being used to simplify pumping problems everywhere. Write, we'll be happy to add your name to our mailing list.

KOBE, INC. *General offices: 3040 East Slauson Avenue | Huntington Park, California*

BTU's per pound of fuel. A hotter fuel could, in effect, give us two gallons of usefulness for every gallon of fuel . . . .

"Although you may expect to see nuclear-powered bombers fly within the next ten years, it will be a very long time before we have a fleet of them so large that our consumption of fuel will be noticeably reduced. Initially, at least, they will be specialized aircraft, designed and built only for those missions requiring unlimited range and endurance.

"The strategic advantages of a nuclear-powered bomber will be like its range—unlimited. For example, one of our main problems today is vulnerability of our striking forces. Due to our limited number of bases, we are forced to concentrate large numbers of Strategic Air Command bombers at too few locations.

"When the day comes that we have a nuclear-powered striking force, we can keep a high proportion of our bombers airborne. While they are flying, they will be safe from attack by enemy long range bombers or missiles. Furthermore, the fuel to keep these bombers going indefinitely will not be the fuel of storage tanks, pipelines, and refueling trucks which make such good targets. The equivalent of thousands of gallons of petroleum fuel will be the relatively small nuclear power source in the aircraft."

Gen. Thomas D. White, vice chief of staff, U. S. Air Force, in address at dedication dinner for Universal Oil Products Co. laboratory, Chicago.

Price Discussion Praised

Dear Sir:

Please send us by return mail, three copies of The Oil and Gas Journal, issue date November 7, 1955.

The story ("Should The Oil Industry Raise Its Prices?") is worthy of further distribution in my opinion.

Byron Layton, Secretary
General Drilling Co.
Oklahoma City.

More on Citronelle

Dear Sir:

On page No. 1 of your issue for November 14, 1955, under the heading "A Glance Ahead" we note that under the paragraph starting "Alabama drilling will be stepped up even more" that you mention five tests running in the Citronelle area, three operated by Gulf, one by Lamar Hunt, and one operated by Zack Brooks.

We are curious to know why Trans-Tex Drilling Co., who spudded the second well in the field and is currently operating in the field, was omitted from this paragraph. This is not to

What a big difference in *comfort* the HINGED BRIDGE makes!

Your workers will say they never had comfort like they get in the new Willson Contour-Spec—and its new hinged bridge adds an extra measure of protection, too!

It's the *hinge* that permits equal pressure at every point of contact with the face . . . snug comfort regardless of facial contour! And it's the hinged bridge that means extra safety because there are no dangerous gaps around the eyes.

Contour-Specs conform to *any* face—heavy, lean, round, long or bony! Result is, a new concept of comfort combined with protection that encourages workers to wear them willingly.

Let them try Contour-Specs—see how well the 47-mm. lenses suit every eye size—feel how easily the lightweight, snug-fitting Butyrate plastic frame "sits" without pressure anywhere. Order a supply from your Willson distributor now.

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More than 300 Safety Products Carry This Famous Trademark

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204 WASHINGTON ST., READING, PA.

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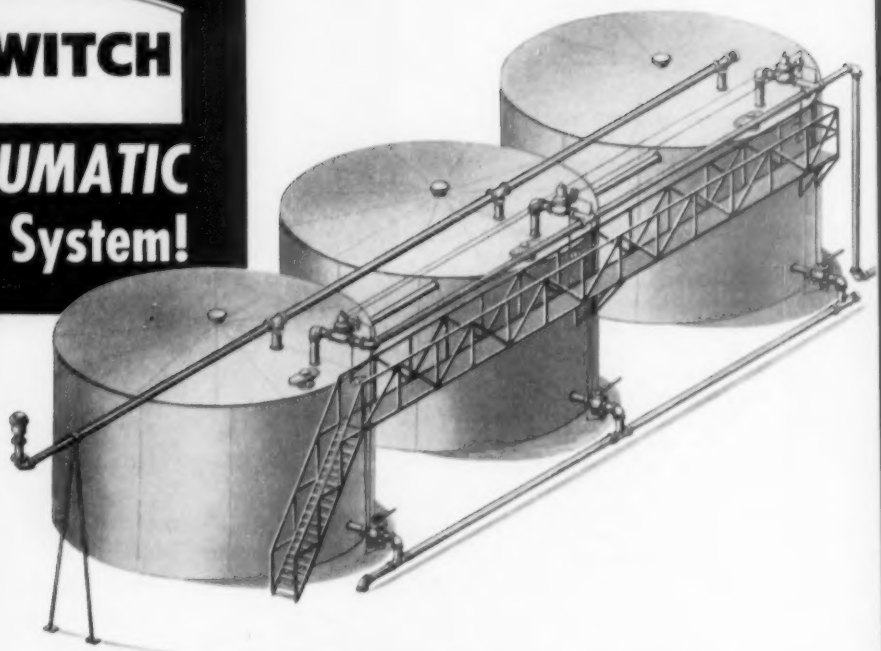
Here's The New BS&B AUTO-SWITCH ...An *ALL-PNEUMATIC* Tank Switching System!



Advantages of BS&B AUTO-SWITCH

- Use of separator gas for the power medium eliminates need for outside power source.
- Most components of the system are standard pieces of control equipment already familiar to the man in the field.
- Automatic controls eliminate the possibility of overflowing the storage tanks.
- Tank batteries in remote locations can operate unattended for long periods of time.
- Direct savings in labor cost and indirect savings in improved production control can easily justify the cost of the equipment.
- Indirect savings also result from the use of safety controls to protect against loss of equipment and oil.
- Normal duties of gauging, "thief-ing" or tank maintenance may be carried on without interrupting the functioning of AUTO-SWITCH.
- AUTO-SWITCH is readily adaptable to "customized" installations designed to fit the needs of the individual lease.

* Also available from BS&B are automatic safety shut-down controls for treater, separator and wellhead to protect lease equipment and prevent loss of oil in cases of emergency.

In keeping with the Oil Industry's demand for more and more fully automatic production equipment, we are pleased to announce the new BS&B AUTO-SWITCH ... an all-pneumatic tank switching system.*

This system is designed to switch the flow of oil from tank to tank as each becomes full. When all tanks are full, the system shuts itself in. Automatic reset is provided to repeat the cycle if upstream tanks have been drained.

Interlocks are provided to prevent the fill valve from opening as long as the manual pipeline valve is open. Full tanks are automatically by-passed. Tanks may be taken out of service for cleaning or repair without interrupting the operation of the battery.

The installation of BS&B AUTO-SWITCH Systems on your tank batteries will result in direct savings in labor cost, and indirect savings in improved production control for higher ultimate recoveries. For complete information, contact your BS&B Representative or write to ...

EFFICIENCY OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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complain, but simply to call your attention to the omission.

E. S. Doyle
Production Engineer
Trans-Tex Drilling Co.
Shreveport.

Editor's Note: Our face is red. Inadvertently, the two tests of Trans-Tex Drilling at Citronelle were omitted from mention in the story.

What's Needed in Smog War

"Much work has been done in the laboratory and in industrial plants on reducing organic compounds and visible particles, but if we are to cure our smog problem . . . we must learn how to control this third culprit, the oxides of nitrogen.

"We have made some progress on the first two, but not nearly enough. Auto exhaust control devices . . . are presently aimed at reduction of part of the organics. Partial reduction of any one type, good as it is, in our opinion can hardly be expected to produce a revolutionary change in our average smog conditions.

"Certain probabilities stand out as types of remedies:

"**. . . Control of domestic burning** of rubbish by substituting cut-and-fill disposal.

"**. . . Further control of airborne particles** from industrial stacks must be attacked from two standpoints: improved combustion could eliminate organic mists, but particles of ash must be removed from stack gases by physical or chemical means.

"**. . . Further control over hydrocarbon** and solvent losses by evaporation means extension of vapor-recovery or combustion-control systems.

"**. . . An effective method** still must be produced to control hydrocarbon emissions from internal-combustion engines. Four areas show promise: fuel cutoff devices operating during deceleration, exhaust converters, fuel injection, and improved maintenance."

Dr. Lauren B. Hitchcock, president of Air Pollution Foundation, in second annual report to Foundation trustees.

Feast or Famine

"The law of supply and demand left to itself will work in the oil business —but only on the basis of feast or famine . . . A feast or famine economy benefits no one—the producer, the refiner, the consumer—least of all the nation. . . .

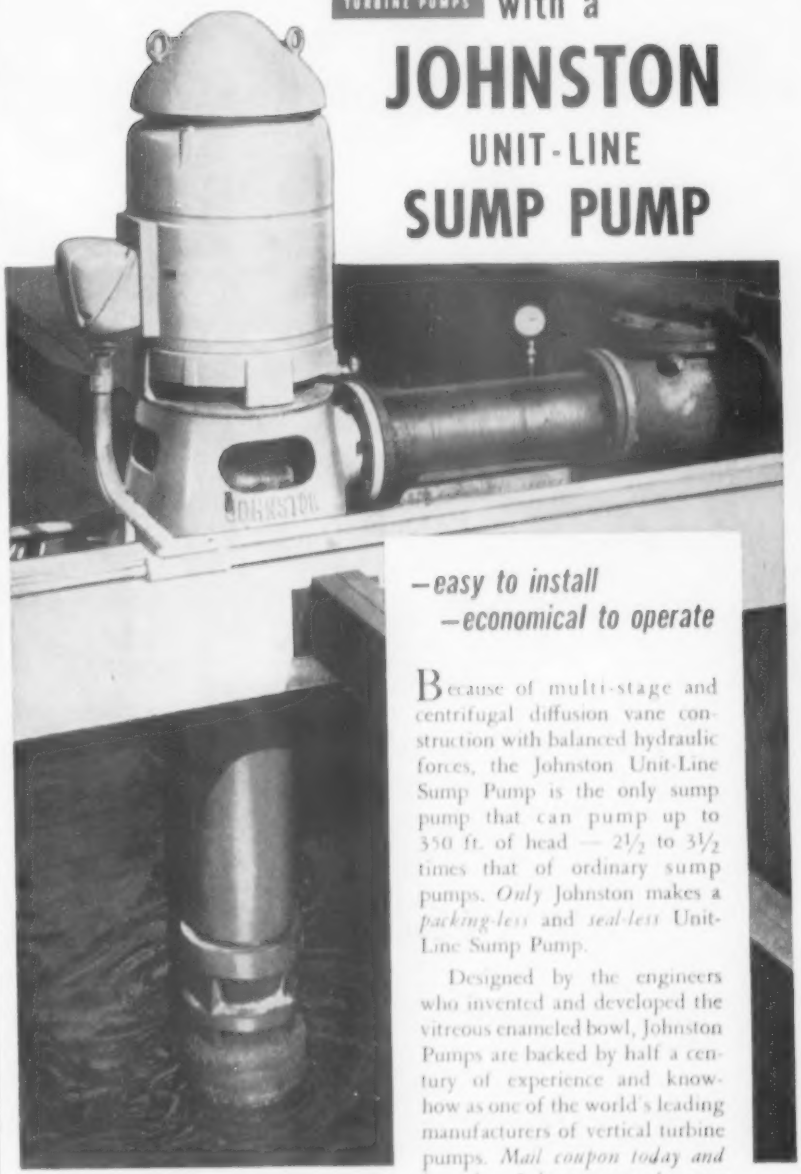
"The problem really hasn't come home to the Rocky Mountain region yet . . . but with adequate transportation facilities available, with a wealth of promising areas still only partially explored, it seems probable that the

Heads up to 350 ft.

JOHNSTON TURBINE PUMPS

with a

JOHNSTON
UNIT-LINE
SUMP PUMP



This Johnston Pump is one of the many popular and dependable Johnston Models.

—easy to install
—economical to operate

Because of multi-stage and centrifugal diffusion vane construction with balanced hydraulic forces, the Johnston Unit-Line Sump Pump is the only sump pump that can pump up to 350 ft. of head — 2½ to 3½ times that of ordinary sump pumps. *Only* Johnston makes a *packing-less* and *seal-less* Unit-Line Sump Pump.

Designed by the engineers who invented and developed the vitreous enameled bowl, Johnston Pumps are backed by half a century of experience and know-how as one of the world's leading manufacturers of vertical turbine pumps. *Mail coupon today and learn how Johnston can solve your industrial pumping problems.*

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(rhymes with walks) (rhymes with scratchy)

PESA

Rocky Mountain region will continue to increase its reserves and its productive capacity . . . and one of these days the question of conservation legislation as exists in other producing states is going to face us."

D. B. Hodges, vice president of transportation and supplies, Shell Oil Co., in address to the Rocky Mountain Oil and Gas Association, Denver.

Ask for Business

"A letter from a new Cities Service customer is full of meaning for all of us who depend upon the sale of Cities Service products to supply the money for our wages and salaries. The customer writes this.

"'A few weeks ago I received my first C-S credit card. You may be interested to know that receiving this card has taught me a good lesson in salesmanship; namely, ask for the order.

"'On my first call, as a local salesman, one of your local men in the refining division offered to get me a credit card and asked me to use it. When he sent this card, he also wrote a very nice friendly letter that really set me to thinking. In the past I could not have been considered one of your steady customers. I certainly will be now, because a good friend gave me a special invitation.

"'This stands out as a good selling lesson to me, because I have several good friends with other major companies, but not one of them asked me to use their products or offered to give me a credit card. This gesture brought home to me the fact that your best friends will not place their business with you unless they are asked to do so.'"

S. B. Irelan, president, Cities Service Oil Co., in a message to employes in the November issue of Empire, company publication.

CALENDAR OF EVENTS

DECEMBER

8-9 Oil Industry Information Committee meeting, Biltmore Hotel, New York City.

1956

JANUARY

9-13 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

16-18 Pipe Line Contractors Association, eighth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

25-27 Eleventh annual Symposium on Instrumentation for the Process Industries, Memorial Student Center, A. & M. College of Texas, College Station, Tex.

FEBRUARY

15-17 National Association of Corrosion Engineers Short Course for Pipeliners, Mayo Hotel, Tulsa.

19-23 American Institute of Mining and Metallurgical Engineers, annual meeting, Hotel Statler, New York City.

24 Natural Gasoline Association of America, Permian Basin meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Institute of Chemical Engineers, Statler Hotel, Los Angeles.

27-29 American Association of Petroleum Geologists, Rocky Mountain Section, Auditorium, Denver.

MARCH

7-9 American Petroleum Institute, Division of Production, Southern District meeting, Plaza Hotel, San Antonio, Tex.

12-16 National Association of Corrosion Engineers, annual convention, Statler Hotel, New York City.

19-21 Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, Tex.

21-23 American Petroleum Institute, Division of Production, Southwestern District meeting, Texas Hotel, Fort Worth.

APRIL

3-5 Annual Corrosion Control short Course, University of Oklahoma Extension Study Center, Norman, Okla.

4-6 American Petroleum Institute, Division of Production, Mid-Continent District meeting, Broadview Hotel, Wichita, Kans.

11-13 Natural Gasoline Association of America, Texas Hotel, Fort Worth.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel & Club, Boca Raton, Fla.

15-17 Texas Independent Producers and Royalty Owners Association, Statler Hilton Hotel, Dallas.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

18-20 American Petroleum Institute, Division of Production, Rocky Mountain District meeting, Cosmopolitan Hotel, Denver.

18-20 National Petroleum Association, semiannual meeting, Cleveland Hotel, Cleveland, Ohio.

19-21 Gas Appliances Manufacturers Association, annual meeting, The Greenbriar Hotel, White Sulphur Springs, W. Va.

23-25 Southern Gas Association convention, Dallas.

23-26 American Association of Petroleum Geologists and Society of Economic Paleontologists, annual meeting, Conrad Hotel, Chicago.

25-27 American Petroleum Institute, Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus, Ohio.

30 May 1 Independent Petroleum Association of America, semiannual meeting, Statler Hotel, Los Angeles.

30 May 4 American Petroleum Institute, Safety and Fire Prevention midyear meeting, Warwick Hotel, Philadelphia.

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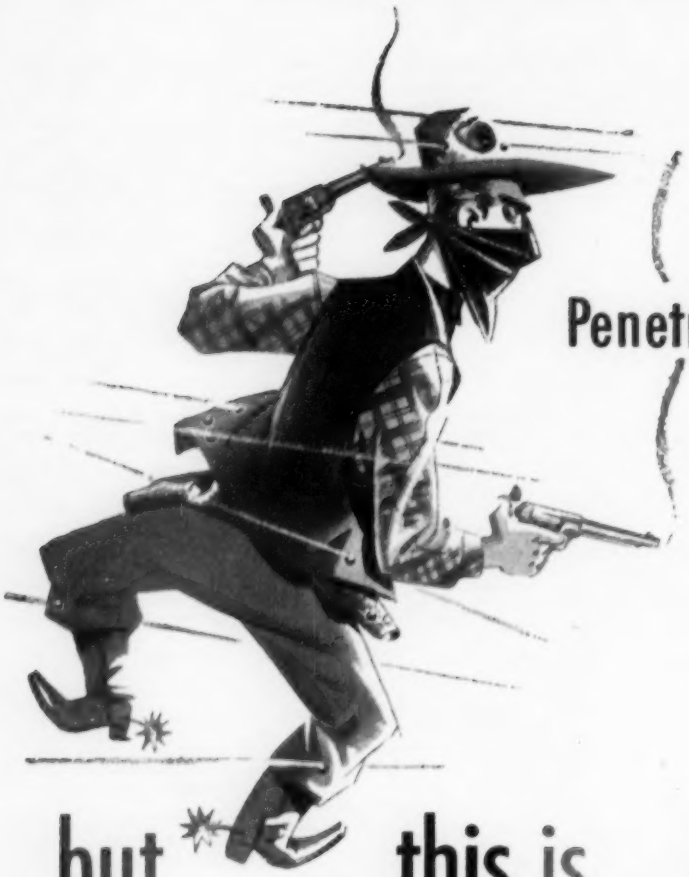

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

When to Look for Oil

THE world is going to have oil running out of its ears along about 1959 or 1960, when upwards of a dozen giant oil fields will be discovered all at once.

This prediction is based on sound statistical analysis conducted by no less than Standard Oil Co. (N. J.).

But before you go any further, let's get the record straight: The statistics are Jersey's; the prediction is ours. There might be an important difference.

Moses Knebel, Jersey's manager for exploration and the current president of the American Association of Petroleum Geologists, is going around the country making talks to local geological meetings on the "Habitat of Oil." He has analyzed the geology and other features of all the giant oil fields—those with reserves of 100,000,000 bbl. or more—discovered throughout the world.

The meat of his conclusions on where to look for giant fields was given on Frank Gardner's page in the Journal's October 10 issue, but this account omitted the data on when the next big discoveries may be expected. One of the slides that Mose uses shows the number of giant fields discovered and the volume of reserves they proved up in every year since the Drake well. Mose always passes over this slide quickly as being a research byproduct of no scientific significance, and Frank Gardner ignored it for the same reason.

But byproducts of no significance are meat and drink to this department. So we don't hesitate to rush in where geologists fear to tread, and make our amazing predictions of things to come.

These are facts: Jersey's statistics, when plotted on a graph, show sharp peaks in big discoveries and low valleys in between. And there is a decided rhythm in the swing of this zigzag. In 1917 there were seven of these giant fields discovered throughout the world, and then there was a big drop both in fields and reserves established. But in 1928 there were 10 of these fields recorded, then another long decline. The years 1938 and 1939 together brought 12 new giants. Then, after a decade of indifferent results, 1949 brought 10 more, but since then there has been a sharp decline down to none discovered so far this year.

Now do you get the picture? Big oil discoveries come in regular cycles of 10 to 11 years, just like the sun spots. It shows up plain as day on the graph. So, if there is any basis at all for the cyclical method of forecasting—and the long-hairs use the method in many other fields—why it is perfectly obvious that the discovery curve will reach another peak in 10 or 11 years from 1949.

Because we have such implicit faith in statistics, geology, and other things we don't understand, we have no hesitancy whatever in predicting that 10 or a dozen giant oil fields will be discovered in 1959 or 1960.

Now that we've told you when you will find these marvelous new oil fields you'll have to go back to Mose Knebel's other statistics—or your favorite doodlebugger—to learn where.

Simple Symbolism

WE don't know why we keep picking on geologists, but so far none of them has canceled his subscription, which proves that either (1) they never read this page or (2) they don't care—doubtless in the order named.

This time the kidding comes from within the ranks of geologists themselves—an anonymous entry in the current A.A.P.G. emblem contest.

This entry depicts a rising sun, "symbolic of hope," surrounded by: an ocean wave, "symbolic of sweat, tears, and formation fluid;" a tortoise, "symbolic of management;" an eraser, "symbolic of flexibility of viewpoint;" and a jug (not a seismograph jug but the more common kind with three x's on the label), "symbolic of frustration." And at the bottom is the universal map maker's symbol for a dry hole, "symbolic of purest scientific achievement, unsullied by mercenary economic considerations."

We hope this entry wins. It not only conforms with all the heraldic rules of artistry and symbolism but also shows that (some) geologists have a sense of humor about their work.

—*Henry D. Ralph.*

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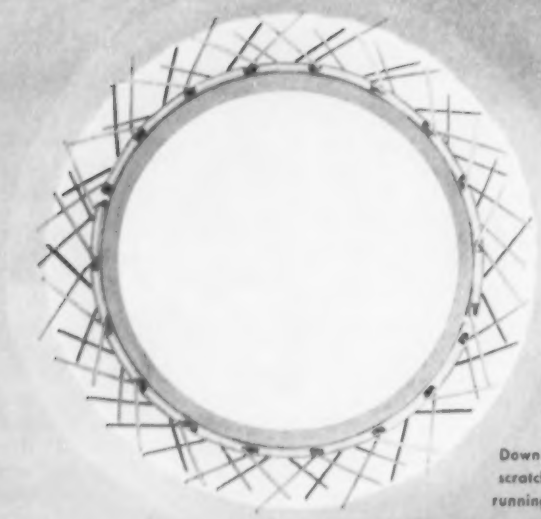
Controlled SCRATCHING

CAN DO FOR YOU!

When running in the casing string . . . the scratcher wires pass readily through sections which are *not* to be cemented, without damaging the vital filter cake.

When lifting the casing out of the slips . . . the scratcher wires do not attack the mud cake because the entire scratcher assembly remains stationary due to the three-foot interval between stop rings.

Only when the "scratching operation" is begun . . . by raising the casing a distance greater than the spacing between the stop rings, do the scratcher wires open outward and start to remove the mud cake.

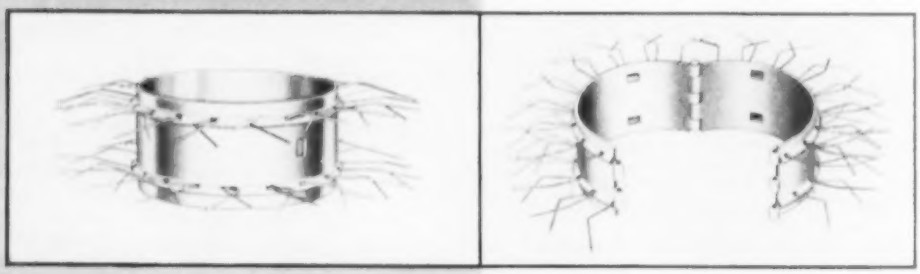


Down view shows scratcher wires in running-in position.

BAKER "Controlled Scratching" means effective removal of the mud cake, but ONLY in the areas to be cemented, where the original formation is exposed for better bonding of the cement.—The expensive filter cake—vital to the successful completion of your wells—is left virtually undisturbed in ALL areas outside of the cementing area. The strong "double-shell" construction, and the "fold-back" wires permit the scratchers to arrive *at the cementing point* in *good operating condition*, and then the overlapping wires effectively remove the mud cake over the 360-degree surface of the well bore.

Available with 4½-inch long (C-45) scratcher wires, or 2½-inch long (C-25) wires, one exactly right for your specific casing program. Contact the Baker representative in your area for helpful recommendations.

Baker Model "C" SOLID RING Wall Scratchers, Product No. 901-C, are merely slipped over the casing and positioned between two properly spaced stop rings.



Baker Model "C" HINGE-LOK Wall Scratchers, Product No. 900-C, are closed around the casing and the hinge is locked with a special knurled closing pin.

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BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

Not too many wells, just not enough wildcats

IS the oil industry drilling too many wells? At the A.P.I. meeting in San Francisco an industry economist made headlines by suggesting that the United States could get by for several years by drilling some 4,000 or 5,000 fewer wells per year than the current rate.

This theory rests on the fact that we have excess crude-producing capacity and on the assumptions that new reserves discovered and producing capacity added per well drilled will remain constant. These assumptions are subject to challenge. In fact, there are strong indications that reserves added per well are on the decline.

Our excess producing capacity is a burden and a handicap to the industry. But there is serious doubt that the top level could be sustained over a very long period unless drilling continues at a high rate. And in any national emergency this margin of safety would disappear fast.

OUR REAL TROUBLE is too many development wells and not enough wildcats. New reserves added during the past couple of years have not been enough to assure the nation of adequate supplies a few years hence if demand continues to increase as expected. What is needed is a shift of emphasis away from immediate producibility and toward exploration.

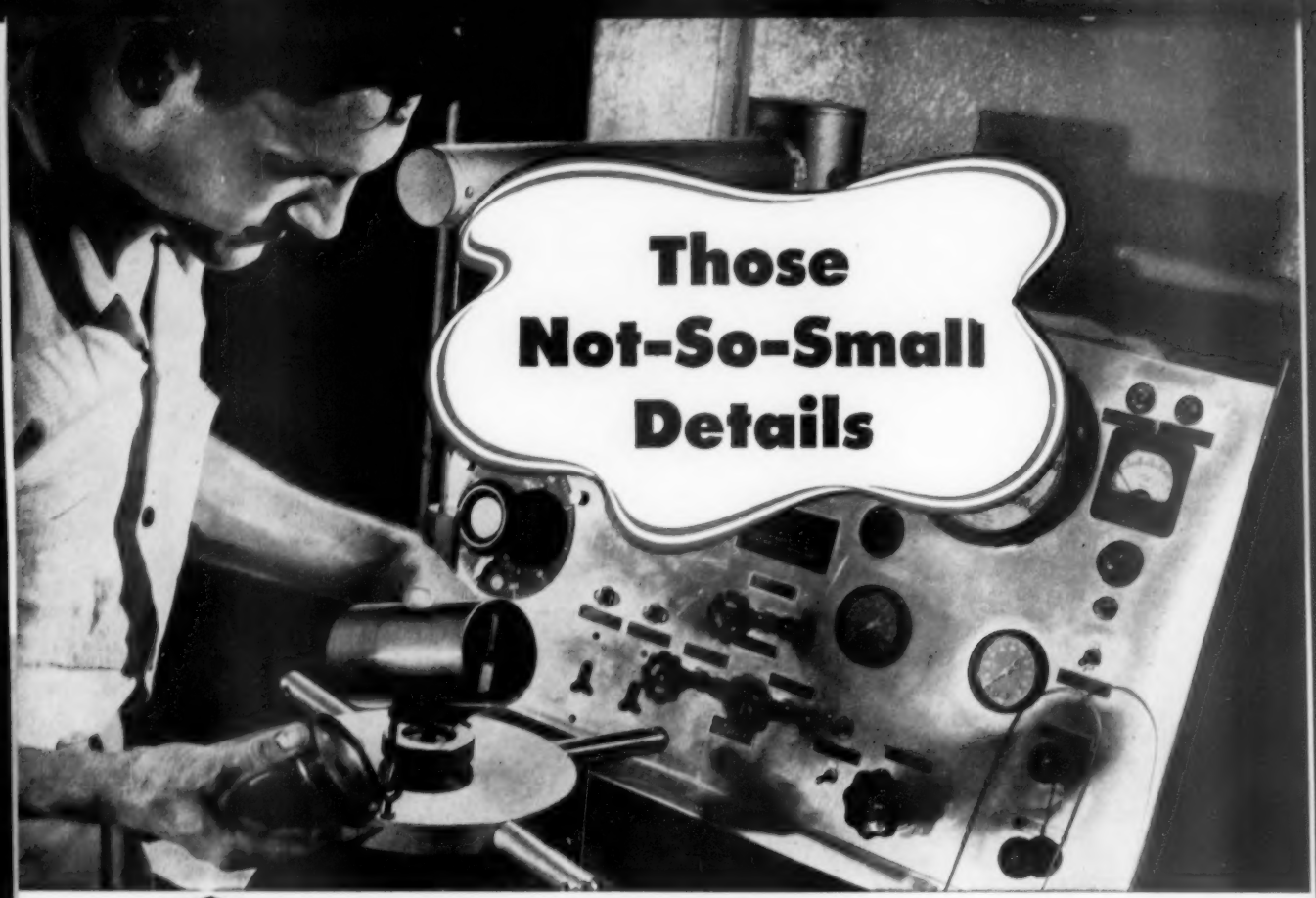
One big reason why drilling has concentrated on known reserves is that the cost of discovering new fields is too high to attract the desirable amount of wildcatting. With the price of oil where it is in relation to costs, operators prefer to play safe by drilling for known oil that will pay out even with low allowables.

What is needed is not less total drilling but a set of economic conditions that will make it attractive for operators to explore for new reserves and at the same time to hold in the ground some of the crude presently producible from developed fields.

THE INDUSTRY CONCEIVABLY COULD PUT itself out of business if it continued to concentrate on producing from known reserves instead of finding new ones. This liquidation process could be hastened by such factors as a prospect that imports will take a bigger share of the market, crude prices which fail to equal replacement costs, or changes in the tax structure and depletion allowance which discourage drilling.

Anything that discourages total drilling is apt to handicap exploration drilling more than it does development work. And the less new oil found, the greater the pressure to exploit known producible reserves. Then the nation will really be in a bind for oil in a few years.

For future defense and prosperity, the industry and the Government should agree on long-range policies that promise market volumes, prices, and tax treatment favorable to both intensive wildcatting and orderly withdrawals from developed fields.



Those Not-So-Small Details

Standard Oil Co. (N. J.) Photo

● Placing the measuring line over the sheave is one of the small details that mean a lot in a safe, successful cementing job. There are many parallels in producing cements to meet the wide range of conditions encountered in the oil fields today.

One of these is the ritual of cleaning and checking laboratory apparatus before each test. Every detail counts, in controlling quality to assure dependable performance, even under the highest pressures and temperatures in deep, hot wells—and in assuring resistance to sulphate action, to protect the casing against corrosion.

Careful attention to all the not-so-small details is the Oil Man's assurance of the properties needed for a first-class cementing job.

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Select Cement to Fit the Job!

Current and significant in . . .

The Industry This Week

Production

• **Wyoming's biggest producing area—Clareton**—will be down to 2 bbl. per well daily in 1959 unless a water flood is undertaken. This is the report given the state conservation commission by Core Laboratories, Inc.

Detailed study indicates the flood, with some gas injection, would more than double primary recovery. The commission, long concerned over the area's future, immediately scheduled a December 19 hearing on the pressure-maintenance program. P. 80.

Look for more water flooding as a secondary-recovery tool in California fields. Feasibility is being proved by two projects which are increasing production three-fold. They are being undertaken by Richfield Oil Corp. in Russell Ranch field and Union Oil Co. and Shell Oil Co. in Dominguez field. P. 76.

A new all-time production high—6,993,700 bbl. daily—was set by free world nations outside the United States in September. Every exporting country except Kuwait recorded gains. P. 93.

Labor

• **A 27½-cent an hour wage increase for each of 2 years**—1955 and 1956—apparently will be the goal of union oil workers when they start negotiating contracts soon. The Oil, Chemical and Atomic Workers Union newspaper says flatly that "oil workers can justify a 55-cent wage increase" for the 2 years. P. 75.

Natural Gas

• **In a precedent-setting decision,** the Federal Power Commission has further entrenched its control over prices of natural gas in the field.

FPC ruled in a case from Oklahoma it could set the rate in an initial contract. The split decision reversed an earlier ruling of the commission's own examiner and brought tart dissents from two commissioners. P. 78.

Montana-Dakota Utilities Co. has run into a roadblock in efforts to put into service its $5 million Tioga-Minot pipeline and $1 million Minot distribution system.

The North Dakota Public Utilities Commission approved the line only if the company would build 618 miles of branch and lateral lines, renegotiate a 4-cent per M.c.f. lower purchase contract, and amend its franchises with cities along the line.

The agency also summoned Montana-Dakota officers to a contempt hearing for not getting a certificate before building the line. P. 88.

Processing

• **There'll be no letup in the polyethylene boom** even though capacity has already far outstripped demand. A new forecast calls for growth of almost 100 per cent the next 3 years. The fresh impetus comes from new low-pressure processes. Consumption isn't due to catch up with capacity until 1960. P. 82.

A new oxidation process has been revealed for making phthalic anhydrite, terephthalic acid, and other polybasic petrochemicals has been revealed. Indiana Standard, which bought an interest in the process, claims it gives better yields and higher purity of products. P. 75.

Commerce Oil Refining Co. plans to break ground at Portsmouth, R. I. in February for its new 45,000-bbl. refinery. It will process Middle East crude. P. 85.

Canadian Gas Deal Carries Big Wallop

- Gas from Peace River will find its way to California markets before long, latest deal indicates
- Future may see one-third of U. S. using Canadian gas, flow of Pacific Northwest pipeline reversed

Joe Reilly

THE Federal Power Commission's approval of small-scale imports of Canadian gas has opened the door through which British Columbia and Alberta some day may supply a major part of the gas requirements in the western one-third of the United States.

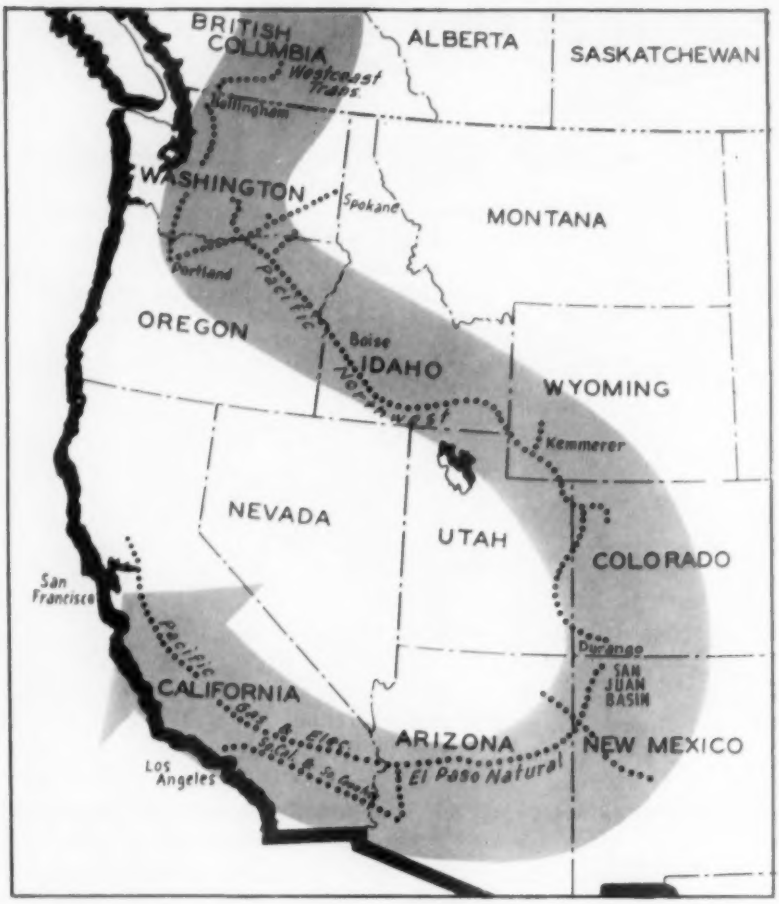
Startling as this conclusion may seem, it is creating little alarm. To the contrary, several pipeline companies are basing their plans for distant expansion or the assumption that natural gas from Canada will be available in vast volumes.

The avenue through which Canadian gas will move into the United States is the 1,466-mile line now being built by Pacific Northwest Pipeline Corp. Part of this gas eventually may find its way to California through a circuitous pipeline system extending southeast into New Mexico then west and northwest to the Pacific Coast.

Pacific Northwest's line was intended primarily to move gas from the San Juan basin of Colorado and New Mexico to a big area now without gas service along the upper West Coast. But within a few years the flow of gas from Canada may become so great as to reverse the movement through much if not all of the Pacific Northwest line.

Gas from Canada will supplement, rather than replace, reserves in this country. The Federal Power Commission, in Order 271 approving the Pacific Northwest line, set a precedent against making any section of the country dependent on foreign gas alone. The company's San Juan reserves still are dedicated to Pacific Northwest markets. But now with Canadian gas assured on this side of the border, those markets will have two sources of supply. In effect, California will, too.

The Pacific Northwest, last region in the country to get natural gas, will have perhaps more reliable service than any other area of such size. And competition between Canadian and United States gas brightens the price outlook for consumers in the area served.



The situation . . . Plans for widespread use of Canadian gas on this side of the border are prompted by logistics. Transmission companies will trade gas where they don't need it for gas where they do need it.

Pacific Northwest has agreed to purchase 303,462,000 cu. ft. of gas per day at the Canadian border. The gas will be bought from Westcoast Transmission Co., Ltd., and delivered through its proposed 650-mile line from the Peace River area of British Columbia and Alberta.

Purchase of gas at the border is to start in January 1958. That will be about a year after Pacific Northwest's line goes into operation.

Pacific Northwest plans to use 250,000,000 cu. ft. daily of Canadian gas to build up its own markets. The other 50,000,000 cu. ft. will go to El Paso Natural Gas Co., which transports gas from the San Juan basin and the Permian basin to California.

Obviously, El Paso has no need for gas at the Canadian border. So instead of taking delivery there, El Paso will get its 50,000,000 cu. ft. a day from the San Juan basin at the southern end of the Pacific Northwest line.

This tradeout is advantageous to both companies. It means Pacific Northwest can reduce the volume of gas going through its line by 50,000,000 cu. ft. per day. And the company will have the advantage of a gas supply much nearer its big markets in the Seattle and Portland areas.

To El Paso Natural, the deal is equally desirable. It gives the firm an extra supply of gas at the mouth of its big system which takes San Juan basin gas to California. The company is always looking for more reserves to feed the fast-growing California market.

Besides providing new supplies where needed, the three-company deal has dollars-and-cents benefits. It gives Westcoast the outlet needed to make its line pay out. To Pacific Northwest it means a profit of 3 cents per M.c.f. since it will buy Canadian gas at 22 cents and dispose of an equal volume

in the San Juan basin at 25 cents. At the same time, El Paso Natural will in effect be paying only 3 cents per thousand for transporting gas nearly 1,500 miles.

Second trade . . . The same principle is involved in a second exchange between the two companies.

El Paso has what might prove to be a big gas reserve in Pinedale field of western Wyoming. The field is separated by nearly 600 miles of rugged terrain from the company's nearest pipeline. But it is only 50 miles from Pacific Northwest's line. So the two companies worked out a second exchange agreement for submission to the FPC.

Action on this deal has been deferred, however.

Under this plan, El Paso would build a line to deliver 50,000,000 cu. ft. daily of its Pinedale gas to Pacific Northwest at Big Piney field. In return, El Paso would get an equal volume of gas from Pacific Northwest's San Juan production.

Flow of gas . . . The purchase of Canadian gas means the flow in the northern portion of Pacific Northwest's line will be reversed. "Obviously," said one observer, "300,000,000 cu. ft. is going to require the use of this line to move gas south."

At the same time, sale of 100,000,000 cu. ft. of gas daily to El Paso at the southern end of the system would mean that much less gas going northward through the line.

The question is how far this trend will go. Some informed sources in the natural-gas industry foresee the day—perhaps only a few years in the future—when the middle portion of Pacific Northwest's line will be temporarily idle. Looking a little farther into the future, they see the possibility of Canadian gas coming all the way to San Juan basin and perhaps some of it going into California.

California dilemma . . . With the fastest-growing population in the union, California is constantly demanding more gas. Its own reserves are dropping. As a result, it must look to out-of-state gas not only because of its population growth but to replace some of its own supplies.

The state now gets practically all of its out-of-state gas from two sources—the San Juan basin and the Permian basin. Roughly half of San Juan's gas is controlled by Pacific Northwest. Much of the Permian basin gas is going to the upper Midwest, where demand likewise is rising.

El Paso, the only transmission company taking gas into California, is always on the prowl for new reserves. No doubt the firm will be eager to get more Canadian gas if handier supplies can't be found for California's future needs. The company estimates its present proven supply will meet its contract requirements through 1974. Without Canadian gas, continued growth in California's population might mean potential gas consumers without meters indefinitely.

Southern California Gas Co. and Southern Counties Gas Co. of California, distributors of gas in the lower half of the state, estimated in a brief recently filed with the FPC that the unsatisfied demand for gas in southern California alone will average 75 billion cubic feet a year between 1955 and 1960. The two companies have about 2,000,000 firm customers now and are adding new meters at the rate of about 100,000 a year. This amounts to obtaining additional gas for a city the size of Rochester, N. Y., each year.

Their brief was filed in support of El Paso's proposal to spend approximately $195,000,000 to loop its line from the San Juan basin to Topock, Ariz. This loop would be 34 in. in diameter and about 450 miles in length. El Paso proposed to put the looping system into operation about November 1956, thereby increasing its delivery to California from 1,405,000,000 cu. ft. per day to 1,755,000,000 cu. ft.

The FPC authorized El Paso to expand its system by 455,175,000 cu. ft. daily. El Paso will get up to 101,150,000 cu. ft. of gas daily from the Permian basin and an additional 252,875,000 cu. ft. from the San Juan basin, plus the 50,575,000 cu. ft. from Pacific Northwest. Another 50,575,000 cu. ft. of San Juan gas will go to El Paso if the Pinedale exchange with Pacific Northwest is approved.

The Southern California distributors pointed out also that the Census Bureau estimates the state's 1960 population at 15,000,000. In 1950 it was 10,586,223.

To further darken the picture, the companies emphasized that new discoveries and extensions of old pools have failed to match gas withdrawals in California. "There has been a gradual but steady decline in known remaining recoverable gas reserves in California since 1946 with the exception of 1948," they noted.

About 70 per cent of the gas consumed in California comes from other states.

Future route . . . If Canadian gas ever serves any part of California why would it take such a roundabout path as the Pacific Northwest system? The answer, say some men in the industry, is apparent.

First, the Pacific Northwest line is

Westcoast Wheels Are Turning

CALGARY.—Flashing of the green light for the Westcoast Transmission Co., Ltd., natural-gas pipeline project will set the Peace River area buzzing with activity.

It will have these immediate results:

. . . Contractors will proceed with clearing and grading of right-of-way for the 650-mile line which will bring Peace River gas from northeastern British Columbia and northwestern Alberta to near Sumas, Wash. Construction will be done by Mannix, Ltd., Calgary; Canadian Bechtel, Ltd., Toronto; R. A. Conyes Construction Co., San Pablo, Calif.; and Dutton-Williams Brothers Co., Ltd., Calgary.

. . . An $8,000,000 processing plant will be built in the Pouce Coupe area of northeastern British Columbia. The plant will extract some 300 tons of sulfur daily from the natural gas, along with gasoline and L.P.G.

. . . Construction will begin on a gathering system to feed the trunk line.

. . . Exploratory drilling will step up tremendously. The Peace River area will see a record number of rigs operating.

Initial capacity of the 30-in. line will be 400,000,000 cu. ft. daily. It is to be increased to 660,000,000 cu. ft. daily eventually. Construction cost is estimated at $120,000,000.

Mainline pipe has already been ordered. United States suppliers have a $20,000,000 contract for 400 miles of pipe. English mills will fill a $12,000,000 order for the remaining 250 miles. Canadian suppliers will provide gathering-system pipe.

Actual pipe laying in the mountains is not expected to start until next spring. But a Mannix crew is already nearing completion of a 20-mile stretch of line near Vancouver. Completion of the Peace River - Vancouver link is scheduled for early 1957.

This outlet for the vast gas reserves will spur exploration in an area larger than the State of Texas. Pacific Petroleums, Ltd., backer of Westcoast, and its associates plan to drill at least 70 additional wells. Imperial Oil, Ltd., currently engaged in a $9,000,000 exploration program on Pacific Petroleums acreage, will expand operations to include wildcatting.

Transcontinental Finishes Laying 36-In. Loop

The longest segment of 36-in. pipe ever laid by a gas-transmission company is now in use by Transcontinental Gas Pipe Line Corp. The company's 1955 looping program, which included 315 miles of 36-in. pipe, has increased the gas capacity of its Texas-New York system by 130,000,000 cu. ft. per day to 695,000,000 cu. ft. Shown in the final stages of construction is the installation of a pig trap on the 36-in. loop near Roanoke, Ala. The $83,000,000 project, also including 219 miles of 30-in. pipe and 57 miles of 12, 16, and 24-in., is complete except for cleanup and minor finishing touches at a few isolated points. The entire job is expected to be completed early in December.

rapidly becoming a reality. Otherwise, it would be much simpler to build a direct line down from Canada than to wander through Idaho, Wyoming, Utah, Colorado, and New Mexico. Within 10 years, the Pacific Northwest line should be roughly 50 per cent depreciated. That means that for a given price you could move gas through it twice as far as through a new line.

Of perhaps greater importance is the fact that the combined Pacific Northwest-El Paso system will permit supply and demand to determine how far southward Canadian gas will flow. This system makes it possible to divert relatively small volumes of gas to the California market as needed. On the other hand, enormous volumes of gas would have to be moved immediately through a direct Canada-California to make it pay out.

Furthermore, the Pacific Northwest line will make potentially vast reserves of gas in the Mountain states available wherever needed—either to the north or the south. Current thinking is that Canadian gas actually will not go to California for at least several years. But the effect will be the same if Canadian gas gradually takes over much of the Pacific Northwest markets, thereby freeing domestic gas for other United States markets.

Pattern set . . . A precedent for reversing the flow of a gas line to the mutual advantage of companies involved was set in 1953.

Then, El Paso and Northern Natural Gas Co. worked out a gas exchange which eliminated the need for a proposed pipeline some 250 miles long. The deal also saved several million dollars.

The situation was this: Permian Basin Pipeline Co., in which Northern Natural held controlling interest, owned reserves in West Texas. The company proposed a pipeline to deliver Permian basin gas to the Texas Panhandle where it would go into Northern Natural's line serving the Midwest. At the same time, El Paso was moving gas southward through a line from the Panhandle to the Permian basin. From there, the gas was going into El Paso's main system to California.

Here's what happened: The companies worked out a surprisingly simple trade. Permian Basin Pipeline swapped 300,000,000 cu. ft. of gas a day to El Paso Natural in West Texas, and in return El Paso gave Northern Natural an equal volume in the Panhandle. This almost erased the need for the present line between the Permian basin and the Panhandle; it completely wiped out the need for a parallel line. All the pipeline that had to be built was a 14-mile link from El Paso's station at Dumas, Tex., to Northern Natural's line.

Actually, since El Paso received more gas at the south end of the line than it delivered from its Panhandle reserves, the company kept the system in operation. But now it moves less gas and in the opposite direction to make up the difference in volume.

This pattern may be used on a much larger scale in the Pacific Northwest system.

Effect of swaps . . . Eventual use of Canadian gas to serve much of the western U. S. does not mean reserves in this country will be left without a market.

All major U. S. reserves already are committed to one or more markets. And growing markets are making ever greater demands on producers and pipeline companies.

To the consumer, of course, Canadian gas would mean two sources instead of one.

Distant future . . . How long will it be before Canadian gas reverses the flow through Pacific Northwest? Nobody knows, and nobody seems greatly concerned. The important fact is that the pattern has been set, and Canadian gas apparently will be available for future needs.

Far into the future, some see the possibility that Candian gas might not only go to California but even into the Midwest. This could be done almost entirely through existing pipelines. It's not inconceivable that Canadian gas some day may flow southward to New Mexico, eastward to West Texas, then north and northeast to Kansas City, Chicago, and Minneapolis.

Nobody is counting on this, at least not in the near future. But it's consoling to have a new source of gas for expanding markets in case they outgrow our own supplies.

"Workers Can Justify 55 Cents . . ."

. . . Union Is Aiming High

DENVER.—Union oil workers may demand wage increases this winter of 27½ cents an hour for each of 2 years—1955 and 1956.

That hint of things to come was dropped in the current issue of the Oil, Chemical and Atomic Workers Union News. It states flatly that "oil workers can justify a 55-cent wage increase."

Neither union president, O. A. (Jack) Knight, nor other union leaders previously had disclosed the amount of increases to be sought in a wage drive launched in mid-November.

The union publication, however, explains the wage outlook this way:

"If the wages of oil refinery workers had increased since 1948 at the same rate their production for their employers had increased, the average wage in refining now would be $3.02 an hour.

"But the actual average refining wage is now $2.47 an hour, 55 cents an hour lower than has been justified by the work refinery employes have been turning out."

New goal . . . Speculation is that the 55-cent figure, approximately 27½ cents this year and a similar amount in 1956, is the goal of the 54-member union bargaining policy committee. It directed its 500 bargaining units to seek "substantial" increases following a meeting November 12-13 in Kansas City.

The bargaining units represent more than 100,000 union oil workers throughout the nation. Most are employed in refineries. Some are in pipeline, oil field, and wholesale marketing classifications.

The last round of wage increases in the industry, granted last March, averaged 10 cents an hour. Knight viewed that as a "boost due in 1954." He said later the union in its current campaign would be negotiating for a wage increase "earned and due in 1955, plus 1956 increases which will be due soon."

What's involved . . . The union publication cited a study made by its own research and education department which shows that productivity—output per man-hour of labor employed—has increased in the oil industry at an average rate of 7 per cent each year during the period since 1948.

The increase in refining during the past year alone was 13 per cent. The output in crude oil and gas production was up 12.2 per cent, O.C.A.W. said.

The union interpreted these figures to mean that "oil workers have been delivering increased 'pay' in the form of work performed to the oil companies at a faster rate than the companies have been delivering pay increases to the workers.

"This increase in work done but not fully paid for is one of the principal justifications for O.C.A.W.'s request for substantial wage increases at this time."

Wage increases have not amounted to 7 per cent a year, the union said, but actually have averaged only about 4 per cent.

"The difference has gone into the profits of the companies," O.C.A.W. charged.

Esso Options Jersey Site

PENNS GROVE, N. J.—Esso Standard Oil Co. has taken option on a tract of about 1,800 acres near here for possible future use as a refinery site.

Company spokesmen say Esso is interested in the South Jersey area on a long-term basis but has no immediate plans for development there. The tract will be considered along with others on the east coast.

Esso emphasizes that if the Penns Grove area is developed, it will not replace existing facilities at Linden and Bayonne, N. J., or Baltimore, Md. Penns Grove is across the Delaware River from Wilmington and about 30 miles southeast of Philadelphia.

Esso also has under consideration refining locations in Virginia and North Carolina.

Pacific Refiners Sold

HONOLULU.—Pacific Refiners, Ltd., has sold its fuel oil and asphalt plant to Standard Oil Co. of California and its L.P.G. business to Honolulu Gas Co.

Pacific stockholders approved the sale to Socal for $2,425,000. Standard of California bought the plant in connection with plans to build a $30,000,000 refinery at Honolulu.

Pacific Refiners will receive 81,000 shares of the Honolulu Gas stock, valued at $13.40 a share. Stockholders will receive one share of gas company stock and $1 cash for each 19 shares of Pacific.

Aromatics may take new role as . . .

. . . Petrochem Process Revealed

NEW YORK.—A completely novel oxidation process for making phthalic anhydrite, terephthalic acid, and other polybasic petrochemicals was announced here last week by Dr. Robert E. Wilson, chairman of Standard Oil Co. (Ind.).

Wilson, speaking before the New York Society of Security Analysts, said Indiana Standard has purchased an interest in the new process. It gives the company an option on exclusive worldwide rights.

Originated by Scientific Design Co., Inc., of New York, the process represents a simplification of conventional oxidation techniques. Dr. Wilson said it gives better yields and higher purity of product.

Its first principal use may involve the oxidation of orthoxylene to produce phthalic anhydride and of paraxylene to make terephthalic acid.

"The process is well advanced at the pilot-plant level," Dr. Wilson said. "It is completely novel and offers outstanding commercial possibilities. By process simplification, compared with current methods, it gives better yields and higher purity.

"Principal current products that can be made by the process are terephthalic acid, raw material for Du Pont's dacron-type polyester fiber, and phthalic anhydride, raw material for various resins, plasticizers, and surface coatings.

"Still more versatile polybasic acids not now commercially available can also be made."

While the schedule for the first commercial application has not been fixed, Dr. Wilson said his company's 1957 budget would allow some capital expenditure for plant construction. Two areas may be under consideration as a plant location. They are Texas City, Tex., where Indiana Standard has basic petroleum aromatics available at the American Oil Co. of Texas refinery, and Whiting, Ind., where the parent company is expanding aromatic-extraction capacity.

No details of the process have been revealed. Patents have not been issued.

Confidence expressed in its practical application indicates that it may have an important bearing on the position of petroleum aromatics in the petrochemical field.

Several projects are now proving that . . .

. . . Flooding Has a Future in California

D. H. Stormont

LOS ANGELES. — Two successful full-scale floods and encouraging results at numerous experimental projects point to greater use of water flooding as a secondary-recovery tool in California fields.

The projects which prove the feasibility of water flooding are the unit operation at Russell Ranch and the cooperative flood of Union Oil Co. and Shell Oil Co. in Dominguez field.

At Russell Ranch, operated by Richfield Oil Corp., a peripheral flood of the 1,200-acre unit is being expanded steadily. Some 15,000 bbl. of formational and shallow-well water are being injected through seven wells. In the next few months the input will be raised to about 40,000 bbl. daily.

The pattern flood at Dominguez is the state's first to cause a substantial increase of oil production. As at Russell Ranch, the operators have not discussed results. But monthly production figures for the fault-block area in which the flood is being carried out indicate the flood has jumped oil output from 600 bbl. to about 2,000 bbl. daily.

Success of these two projects has done much to eliminate pessimism as to the feasibility of California flooding operations. This change in attitude is reflected in the recent growth of water flooding.

At the first of the year, 75,000 bbl. of water were being injected daily at 34 floods. Today some 100,000 bbl., of which 20,000 bbl. is sea water, are being injected at 36 projects. These are exclusive of brine disposal projects or pressure-maintenance with high-pressure water.

Dominguez pays off . . . The cooperative flood being carried out by Union and Shell in the East Central fault block at Dominguez is unique. A water barrier first was built up between the two properties. This was to prevent oil migration from one property to the other *(The Oil and Gas Journal, November 29, 1954, page 46)*.

At the time the project was started in July of last year, output of all Pliocene pools in the block was 1,600 bbl. daily. Production from the 4,200-ft. first-zone pool was 600 bbl. daily.

During last September, total output of the East Central block was 2,720 bbl. daily. As only one new producer was completed while the flood was under way, this would indicate it has been responsible for a 1,100-bbl. daily increase. Oil production from the 120-acre pool is believed to have climbed to almost 2,500 bbl. daily.

The irregular five-spot flood involves 17 injection wells, four of them along the common boundary, and 16 producers. Average producing interval open to flooding is approximately 350 ft. A volume of about 22,400 acre-feet is involved. Estimated cumulative production from this interval at the flood's inception was 14,000,000 bbl.

More than 4,000,000 bbl. of Dominguez field waters have been injected so far. Current input is around 13,000 bbl. daily. Prior to their injection, the waters are treated with quaternary ammonium chloride and filtered.

Wilmington pilot floods . . . Two experimental projects in the Long Beach Harbor area of the Wilmington field are indicating that flooding will benefit both ultimate oil recovery and pressure maintenance.

Pressure maintenance is of particular interest as a means of checking surface subsidence resulting from oil and gas withdrawals.

These trial floods, therefore, may be the forerunners of a full-scale flood involving as much as 1,000,000 bbl. daily.

A recent study concluded this much water input would be needed for 3 years in order to "fill up" the shallow Tar, Ranger, and Terminal zones. Because the land surface is still subsiding in downtown Long Beach, the report urged immediate action *(The Oil and Gas Journal, November 28, page 48)*.

The project would require that city properties in the harbor area be unitized with those of other oil operators. This action already has been recommended by the Long Beach City Council. Action by the state legislature would be required before the plan could be placed in effect.

Long Beach Oil Development Co.,

as contractor for the City of Long Beach, has injected more than 45,500,000 bbl. of ocean water into a 3,000-ft., 65-acre pool. Initial input through two wells was at the rate of 4,000 bbl. daily. The current rate is 15,000 bbl.

Production from the three wells originally completed in the block 5-B pool was about 135 bbl. daily. Currently it is 330 bbl. daily. A portion of the gain is due to the completion of a fourth well and the recompletion of another.

Because of leakage to adjacent fault-block pools, reservoir pressures have not increased materially. It is significant, though, that they have stabilized at higher withdrawal rates.

Use of ocean water . . . An unusual aspect of this flood is the use of sea water. Filtered brine is obtained from three 120-ft. wells drilled adjacent to the input wells. They have tested at rates substantially higher than their average 5,000-bbl. ouput.

Union Pacific Railroad has been injecting sea water at rates of 1,000 to 3,000 bbl. daily in a Tar-Ranger zone pilot flood for the past year. A third project soon to start at Wilmington is that of Richfield Oil Corp. on City of Long Beach properties in fault-block 6.

Still another project where sea water is being used is that of Continental Oil Co. in the San Miguelito field near Ventura. Source of water there is a shallow well dug beneath the tidelands. As at Wilmington, the ocean water was found to be quite compatible with formation waters. Prior to filtration, sulfur dioxide, and quaternary ammonium chloride are added for controlling bacteria, corrosion, pH, and oxygen content.

Approximately 2,000 bbl. daily are being injected into a 7,100 to 8,800-ft. pool. The interval flooded averages about 550 ft., of which some 200 ft. is oil sand.

Resid Stocks at Low Point

LOS ANGELES.—Stocks of residual fuels on the West Coast have hit their lowest level in 7 years. The drop is due to the continued large volume of resid moved from the state by tanker.

Since last December resid inventories have declined continuously. The current level is about 13,750,000 bbl., compared with about 30,000,000 bbl. a year ago, according to Bureau of Mines and weekly American Petroleum Institute figures.

During the 10-month period December 1954-September 1955 the movement to Atlantic and Pacific foreign ports totaled 30,084,000 bbl. In the like period of 1953-1954 they totaled only 14,076,000 bbl.

Preliminary figures for October indicate that residual fuel supply was 361,000 bbl. daily, demand was 379,000 bbl., and that stocks decreased at the rate of 18,000 bbl. daily. At a level of 14,492,000 bbl., stocks were 15,174,000 bbl. below that at the first of the year.

Merger Completed

Leonard, Roosevelt, and Mid-West united in deal

ALMA, Mich.—The merger of Leonard Refineries, Inc., Mid-West Refineries, Inc., and Roosevelt Oil & Refining Corp. went through on schedule November 30.

Leonard, the surviving company, will have three operating divisions and four subsidiaries *(The Oil and Gas Journal, October 17, page 101)*.

The tentative slate of top officers, subject to approval of directors, has Reid Brazell as president; John E. Pfarr, administrative vice president in charge of manufacturing; L. R. Kamperman, administrative vice president in charge of marketing; L. A. Woodward, senior vice president in charge of supply and transportation; Robert L. Anthony, secretary-treasurer; and E. Allan Morrow, vice president and general manager of the Roosevelt division.

No chairman has been elected for the 16-man board of directors.

Three operating divisions of the parent company will be supply and transportation, manufacturing, and marketing. Manufacturing will break down into Roosevelt, Mid-West, and Leonard divisions. Marketing will have those three divisions plus an industrials division handling such products as asphalts and heavy fuels.

The new integrated company will operate four subsidiaries. Leonard Crude Oil Co. will handle all gathering lines of the three merged companies and Michigan Ohio Pipeline Co. all common-carrier lines. The remaining subsidiaries are McClanahan Refineries, Inc., and ROC Terminal Co.

Texas Production Up

SANTA FE.—Texas will produce 1,020,654,047 bbl. of crude oil during 1955.

This estimate was released by Ernest O. Thompson of the Texas Railroad Commission during the Interstate Oil Compact Commission meeting last week. He said the increase would amount to 65,991,120 bbl., or 180,797 bbl. daily above 1954.

At $2.80 per barrel, the added production raises Texas' oil income $184,775,136 over last year.

Refining Briefs

BAKERSFIELD, Calif.—Two phases of Bankline Oil Co.'s three-point modernization program are under way at its 8,000-bbl. Bakersfield refinery. Fluor Corp. is completing engineering of a 4,000-bbl. fluid coker which is due to go on stream late next year. Bankline also is converting its hydrofluoric acid alkylation unit to a sulfuric acid alkylation unit. A catalytic reformer is planned later.

PHILADELPHIA.—An International Congress on Catalysis will be held here next September 10 to 14. It will bring together scientists of many countries for exchange of ideas and opinions on all types of catalytic development, including those pertaining to petroleum conversion. Financial support will come from academic and nonprofit institutions, oil and chemical companies, and the National Science Foundation.

HOBBS, N. M.—Famariss Oil & Refining Co. has placed New Mexico's first Platforming-Unifining unit on stream here. The combination unit has a capacity for processing 650 bbl. per day of straightrun refinery gasoline and raw well distillates from Monument crude. The unit, designed, engineered and licensed by Universal Oil Products Co., was built by refinery personnel.

PEACE RIVER, B. C.—X-L Refineries, a division of Excelsior Refineries of Edmonton, will be on stream late this year with a new $2,000,000, 2,000-bbl. per day refinery. The plant will process high quality Peace River crudes. It will produce high octane gasoline, diesel and jet fuels, burning oils, and heavy residual fuel oil. Located 500 miles from the nearest refinery, it will serve the Peace River area along the Alaska Highway.

TULSA.—Refining Engineering Co. will design and build a 1,500-bbl. Houdriformer for Continental Oil Co. at its 4,300-bbl. Artesia, N. M., refinery. The reformer, licensed by Houdry Process Corp., will process straightrun naphthas to produce high-octane gasoline blending stock.

PHILADELPHIA.—Sun Oil Co. is converting its Toledo, Ohio, refinery, acquired in 1894, into one of the most modern in the industry. Under a continuing expansion program started in 1946, processing units have been revamped and enlarged. A new furfural unit was put on stream this summer. An alkylation unit will be completed next April. The furfural unit processes tower bottoms into catalytic charge stocks and high aromatic fuels.

FPC Jolts Producers

In precedent-setting decision, agency assumes control over initial contract rates of gas sold in the field

Bertram F. Linz

WASHINGTON.—Independent producers who hoped for some flexibility in pricing their gas got another blow from the Federal Power Commission last week.

In a precedent-setting order, the FPC told Signal Oil & Gas Co. it would approve sale of gas to Cities Service Gas Co. only if Signal cut its initial contract rate of 12 cents per M.c.f. back to the prevailing field price of 10 cents.

Chairman Jerome K. Kuykendall and Commissioner Seaborn L. Digby dissented vigorously from the 3-man majority. They questioned the legality of the order and the authority of the FPC to fix prices arbitrarily.

This was the first time the commission passed on a price initially filed by a producer. Its action, in effect, places independent producers on a par with interstate pipelines. In fact, the majority opinion said there is no basis to distinguish between them.

Who opposed . . . In applying for a certificate to sell gas, Signal reported an initial rate of 12 cents on which it had reached agreement with Cities Service. The latter was to build a 15½-mile pipeline to move gas bought at Signal's Carter County plant to its own lines in Garvin County, Oklahoma, at a cost of $541,050. The initial take was to be 30 million feet a day, to be increased by 15 million feet by the end of this year.

The price was challenged by Oklahoma Natural Gas Co. and Lone Star Gas Co., as well as by the FPC staff. They charged the 12-cent rate would trigger price increases under favored-nation clauses in other contracts.

Favorable hearing . . . An FPC examiner recommended that the certificate be issued without conditions. He rejected a staff study showing that Signal would make between 8 and 16 per cent on its investment at the 10-cent price. He said that under the staff's theory even a 10-cent rate might be considered too high.

If there are to be any rate conditions, the examiner said, they should not be based on the idea that the prevailing area sales price is just and reasonable, whatever it may be, without further proof.

In overruling the examiner, the FPC denied Signal's contention that it lacks the power to impose rate conditions. It said it "has long followed the practice of imposing rate conditions where appropriate in granting certificates."

The FPC warned producers that the acceptance of a rate schedule for filing does not indicate approval. It is merely a procedure by which the producer is informed his filing satisfies formal requirements of its regulations.

"Unless and until a record is made which will support this increase (over the prevailing field price), we should not countenance such an unsupported rate increase," the FPC said. But there is nothing in its action to stop Signal from filing for an increase "which it may find necessary and which it is able to support," it added.

The FPC made an effort to soften the blow. The condition in this case will merely "hold the line," it said, "until experience and time have given us the opportunity to develop more comprehensive criteria governing determination of rates of independent producers."

Dissenter . . . The Supreme Court's decision in the Phillips case puts independent producers definitely under the Natural Gas Act, Kuykendall said. But, he warned:

"The application of the certificate law to producers seems unavoidably to lead to anomalies and to many results which do not advance or protect the public interests, but only hamper the industry and increase the work load of the commission."

Kuykendall assailed the idea of lumping producers and pipelines. The latter's facilities are directly under FPC control. But the producer is in a different position. His production and gathering facilities "are not subject to our jurisdiction," he pointed out. They are constructed without interference from the FPC and before any application for a certificate to sell is filed.

"When sales are made by a producer, under either permanent or temporary authority, pursuant to a filed rate schedule, I know of no way by which the applicable rate can be reduced by the commission other than through proceedings under Section 5," Kuykendall said. "I am unable to find the source of the power which the majority purport to exercise in fixing the 10-cent rate."

"Virtually all state and federal laws relating to powers of regulatory agencies recognize that such an agency does not and cannot have the knowledge or ability to devise an initial rate, and the power to suspend such a rate is therefore withheld," he pointed out.

The only way to avoid Section 5 proceedings, Kuykendall suggested, would be to withhold temporary certificates. The FPC could refuse to allow rate schedules to be filed until each producer had secured a certificate after hearings, with such conditions as the FPC might impose. But the remedy would be worse than the ailment, he said. It would cause waste of gas and unnecessary money loss to many producers. This would tend in time to increase the price of gas and impair existing service.

Pointing out that in another case the FPC accepted an initial rate of 18 cents, which included gathering tax, Kuykendall said its action on Signal's application, if not "capricious" certainly is "arbitrary."

Vital issue . . . The FPC majority quoted "precedents" to support its action.

But Digby said "the use of such precedents in dealing with the independent producers seems very questionable even assuming that Section 7(E) is so broad as to authorize us to fix an initial rate by a condition in a certificate in lieu of a rate proceeding."

"We do not require and thus we do not have the information upon which to ground a finding as to what would be a reasonable and just initial rate as we have in the pipeline applications," Digby said.

"It is clearly unfair to a producer applicant to tamper with the contract that was arrived at as a result of arm's-length bargaining," he declared.

"In view of all the circumstances in this case, I think that the price condition in the Signal certificate does not qualify as a reasonable condition under Section 7(E) and that the legality of such a condition is doubtful."

Texaco Adds New Units

TULSA.—The Texas Co. will add a Hydrotreater and viscosity breaker at its Eagle Point Works, Westville, N. J. Contracts for design and construction work have been awarded Refinery Engineering Co., Tulsa.

J. S. Worden, vice president of the Texaco refining department, says the Hydrotreater will treat cracked distillates from the fluid catalytic cracker, utilizing hydrogen produced by the existing Platformer. The viscosity breaker will process vacuum residuum to produce high quality fuel oil with a controlled viscosity. Both units will be completed in 1956.

Line Conversion Still On

U. S. rejection of wartime Gulf Coast-East Coast crude line will not affect Little Big Inch switch to products

WASHINGTON.—The problem of getting an emergency supply of crude and products to the East Coast during wartime remains unsolved this week.

The Government has virtually killed competing plans of Texas Eastern Transmission Corp. and American Pipe Line Corp. to build a Gulf Coast-East Coast line. The Gulf Coast was ruled out as a source of supply. But the action had no effect on Texas Eastern's planned conversion of the Little Big Inch from natural gas to products.

It was part of the company's overall plan, but Texas Eastern did not ask government aid for this portion of the national-defense project.

Nor does it need any government authority to make the change other than the clearances already obtained from the Federal Power Commission. The Little Big Inch, a 30-in. line stretching 377 miles from Beaumont, Tex., to Moundsville, W. Va., is to be shifted to products with capacity at 375,000 bbl. a day.

Texas Eastern has already completed pipe laying on a $70,883,000 natural-gas line from near Beaumont to Kosciusko, Miss. It will easily make up for the 200,000,000 cu. ft. capacity the company will lose through the conversion.

The picture for the wartime line was changed when the Oil and Gas Office of the Interior Department turned to Canada and the Williston basin instead of the Gulf Coast for emergency crude supplies.

Texas Eastern and American had offered competing proposals for pipelines. Both called for either the spending of government funds or government backing of loans. Their merits were argued before Defense Mobilizer Arthur S. Flemming in a public hearing 2 months ago *(The Oil and Gas Journal, September 19, page 90)*.

Although Flemming indicated the line from the Gulf Coast is dead, he said he would defer a final decision until after December 10. That's when a more complete report on crude supplies will be filed by Hugh A. Stewart, director of the oil and gas office.

Why the change . . . Flemming's letter to the pipeline firms noted that resources in Alberta and Saskatchewan increased this year. More importance now is attached to reserves in the Williston and Denver-Julesburg basins.

Two pipelines have been built, one from the Williston basin to connect with the Platte system at Guernsey, Wyo., and the Arapahoe line from the Denver-Julesburg basin to Kansas. The Service pipeline has been enlarged.

Stewart said the requirements of the East Coast are 1,000,000 bbl. per day, "regardless of where it comes from."

"From these above facts we are convinced that within a reasonable time, the developments mentioned will make it possible to meet most of this crude-oil requirement from sources other than the Gulf Coast as far as Lima and Pittsburgh," Stewart reported. "The problem of getting the crude from these points to the East Coast is another matter."

No existing proposal includes a line from Lima east. Stewart predicted that if one is built in the foreseeable future, it will have to be done at government expense. He suggested three possibilities:

. . . Pumps, valves, and fittings could be bought by the Government and stockpiled in the manufacturers' hands on a circulated inventory basis.

. . . The same program could be followed, including also line pipe, either fabricated or unfabricated.

. . . The line could be built by the Government and held on a standby basis.

Sun Opens New Research Lab

DALLAS.—Sun Oil Co. has completed its new production research and development laboratory at Richardson, Tex., just north of Dallas.

The new lab will be dedicated December 7. John G. Pew, Sun vice president of production at Philadelphia, will be the principal speaker.

Prior to the dedication, Sun's Southwest production division headquarters staff, about 600 strong, will tour the laboratory December 5 and 6. Senior and graduate science students from Southern Methodist University and other guests will get a look at it December 8.

The laboratory proper is a one-story, steel and masonry structure with about 20,000 sq. ft. of floor space. A similar service building with 10,000 sq. ft. of floor space is connected to the main building by a covered walkway.

The lab houses more than 60 Sun employes specializing in production and exploration research. Research activity will be concerned with geology and geophysics, reservoir mechanics, and production technology. The lab also will serve as headquarters for two groups supplying general services to the operating department—these are the former Dallas production laboratory and the Dallas paleontological lab.

All production research formerly handled at Sun's physical laboratory at Newton Square, Pa., now is concentrated at Richardson. All geological research has been transferred to Richardson from Dallas, Abilene, and Corpus Christi, Tex., and from Lafayette, La.

Sun's Beaumont production lab, however, which serves the Gulf Coast division, will continue to operate. Some geophysical research also will continue to be conducted at the geophysical lab at Amelia, Tex., near Beaumont.

Heading the Richardson installation is F. L. Johnson, formerly head of Sun's physical lab at Newton Square. He will be director of production research and development.

Flooding Prescribed for Ailing Clareton

- Core Lab says production will fall below 2 bbl. per well daily by '59 without pressure maintenance

- Line-type flood believed best way to step up output of Wyoming's biggest field

Robert J. Enright

CASPER, Wyo. — Greater Clareton Area field, Wyoming's biggest oil pool and one of the largest in the country, faces a pretty dismal future.

The Wyoming Oil and Gas Conservation Commission and Greater Clareton producers were told last week that oil production in the field will be down to 2 bbl. per well by the end of 1959 unless some sort of pressure-maintenance program is launched.

This bleak prediction came from Core Laboratories, Inc., which was retained by the commission last August to study the reservoir and recommend action to prevent waste and increase recovery.

In the just-completed study, Core Lab says the huge 90,450-acre field had a reserve of only 7,600,000 bbl. of oil left of an estimated 21,100,000 bbl. producible under primary methods. This is an average of only about 11,900 bbl. for each of the field's 641 Newcastle sand wells.

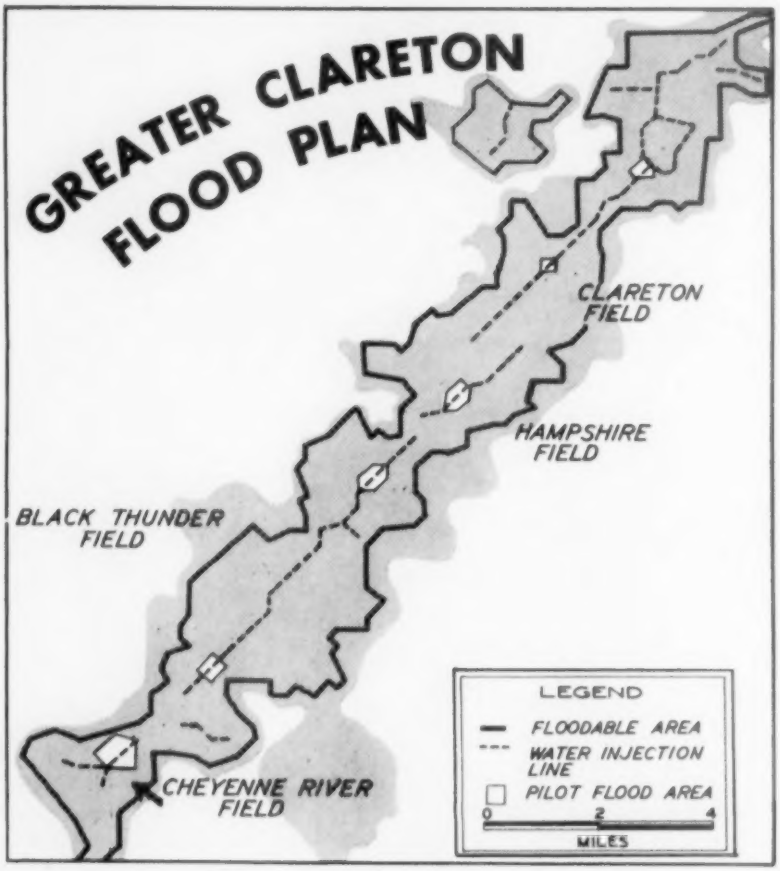
By the end of 1959 these wells will be producing a total of only 1,000 bbl. a day—less than 2 bbl. per well. All of the wells are less than 5½ years old—considered the infancy period for most oil wells.

Gas production currently is climbing as is customary in a solution-gas-drive type pool when oil output begins to drop. The field's gas output, however, will soon level off and by the end of 1959 will have declined to about 9,000,000 cu. ft. a day, the report predicts.

The commission has called a hearing December 19 to review Core Lab's report.

The brighter side . . . Though Greater Clareton appears to be something of a dud as oil fields go no matter what is done, Core Lab's report predicts that operators could more than double primary recovery by gas and water injection.

Primary recovery would be only 21,100,000 bbl. of the pool's estimated 167,689,000 bbl. of stock tank oil in place. Ultimate recovery could be increased to 27,800,000 bbl. by gas injection alone, to 46,100,000 bbl. by water flooding, and to 50,600,000 bbl. by injecting both gas and water, Core Lab estimates.



The report says core analysis work showed the Newcastle sand is susceptible to water flooding. Six pilot injection projects are recommended to evaluate a field-wide project.

Cost of the pilot floods would be about $300,000. Extension of these pilots to the presently developed area would cost another $1,700,000. To completely develop and inject water into the entire floodable area, the report says, would cost roughly $10,000,000. About $6,500,000 of this would go for drilling 20 more input wells and about 80 producers.

The injection plan . . . The report recommends that at least 75 per cent of produced gas be recycled as soon as possible and a full-scale water flood started when the water pilots prove it practical.

A line-drive type flood is recommended with input wells running northeast-southwest through the center of the field. (See map.)

This type of operation, Core Lab says, would:

. . . **Require the smallest** initial outlay for wells and equipment.

. . . **Maintain current income** higher than a pattern flood and perhaps to the maximum amount possible.

. . . **Flood the maximum** number of floodable acre feet.

. . . **Require less water** for injection. The volume of water needed for this type of flood was set at 310,000,000 bbl. over the 20 to 25-year life of flood.

The proposed line-drive flood, the report admits, might have to be altered somewhat pending further information on the existence and nature of a possible fracture pattern in the pay. There aren't enough data available now to determine the direction or pattern of the fractures or to determine its effect on a water-injection program.

More information on this should come from the proposed pilot floods.

Unitization? . . . If water-injection recommendations are followed, the report

says, it is apparent that consolidation of individual interests will be required.

The line-drive plan, however, is particularly adaptable in Clareton because the unitization could be accomplished in small pieces. The field could be divided into segments by east-west boundary lines. Flooding could then begin within each segment as the interests in each were unitized.

Hectic history . . . Greater Clareton Area field actually is made up of several fields formed by pinchouts of porosity and permeability in the Newcastle sand.

It includes four large pools—Clareton, Black Thunder, Hampshire, and Cheyenne River—and several smaller ones, including Sherwin, Snyder Creek, Dogie Creek, Rochelle, Wagonhammer, Rankin, Leverett, and Long Green.

There are no structural features to which oil accumulation can be attributed. There is a monoclinal dip trending southwest-northeast.

The first producing well in the area was brought in in Clareton field in July 1950. Development was fairly slow through 1951 and 1952, averaging about four wells a month.

Things got hot in 1953, reaching a peak in October when 45 wells were completed. Drilling activity remained high through 1954 and development was essentially complete at the end of the year.

The Newcastle sand producers generally were gun perforated then treated with acid and small-volume hydraulic fracturing jobs. Such completions resulted in high initial potentials in spite of thin sand section and low permeability.

Production in the four larger fields reached maximum output of around 620,000 bbl. a month in the summer of 1954. It has dropped rapidly—standing at about 310,000 bbl. in June 1955.

Bottom-hole pressure skidded and gas-oil ratios shot up. In March 1955, the Wyoming Oil and Gas Conservation Commission clamped down.

It authorized the state mineral supervisor to contract gas-oil ratio tests on all producing wells in the Greater Clareton area and ordered all wells with gas-oil ratios over 5,000:1 shut in. The tests were completed by July 15 and a great many wells with high ratios ceased production, including all those in Cheyenne River and the smaller fields.

The commission extended the shutdown order July 25 and authorized the mineral supervisor to arrange with a reputable engineering firm to study the field and recommend action.

MOUNTAIN TOP drilling site is staked by Art Erickson, left, chief geologist for Northern Natural Gas Producing Co., and Lloyd Cumming, Phillips Petroleum Co. geologist.

CANADA'S 2-A Savanna Creek well has shown promising gas production from several zones. Discovery of the field disproved theories that the Canadian Rockies were a barrier to production.

Canada's Savanna Creek Field Climbs Mountain

CALGARY.—Stakes have been driven for Canada's highest drilling site—on a mountain top 8,000 ft. high.

The 3 Savanna Creek will be drilled soon on top of Plateau Mountain in the Canadian Rockies 60 miles southwest of here. It will be the third well in the promising Savanna Creek natural-gas project. Loffland Brothers of Canada has the contract for the test, which is projected to 12,500 ft.

The discovery well held especial significance to geologists because it lies in the Rockies and not in the foothills. It was believed previously that production was limited by the first range of the Rockies in Canada and Montana. The discovery tested a total of 50 million cubic feet per day from four zones *(The Oil and Gas Journal, June 6, page 172).*

The 2-A Savanna Creek, about a mile east of the discovery, flowed an aggregate of 32.65 million cubic feet of gas daily in tests from five zones. The tests were made over the interval of 7,700 to 8,301 ft. in the Rundle group of the Mississippian age. The tests showed a producing horizon in excess of 600 ft. Casing was cemented at 8,339 ft., but the well will not be completed until additional wells have been drilled. Results from the two wells show the productive section has a closure of more than 1,500 ft. Neither was drilled on the crest of the structure.

The 78,440-acre Savanna Creek spread is on Candian Government property.

Phillips Petroleum Co. is operator and part-owner of the project. Other interest holders are Northern Natural Gas Producing Co., Husky Oil & Refining, Ltd., Canadian Anaconda Oil Co., Ltd., and Target Petroleum, Ltd.

Polyethylene Goal Hiked

Spencer Chemical official says plant growth to continue 3 years then wait till 1960 for consumption to catch up

NEW YORK.—A sharp increase in total polyethylene capacity—almost two fold—is forecast for the next 3 years.

Capacity has already jumped from 125,000,000 lb. in 1952 to 452,000,000 lb. this year. Plants now building raise the figure to 571,000,000 lb. And it's expected to reach 830,000,000 by 1958, then remain on a plateau for a few years.

Leading the way in this spectacular rise will be the versatile new low-pressure polyethylene. Capacity now is thought to be under 1,000,000 lb., in pilot plants or semi-commercial facilities, as the newly discovered process is barely out of the laboratory.

But the low-pressure process may account for 245,000,000 lb. by 1958, growing from nothing to some 30 per cent of total capacity in 3 years. It is this discovery that has apparently changed the timetable and led to a forecast of still greater expansion before construction levels off.

This detailed projection was presented by Mark B. Stringfellow, manager of market development for Spencer Chemical Co., before the Atlantic Regional Conference symposium on "Plastics for Packaging." The symposium was sponsored by the New York Section of the Society of Plastics Engineers.

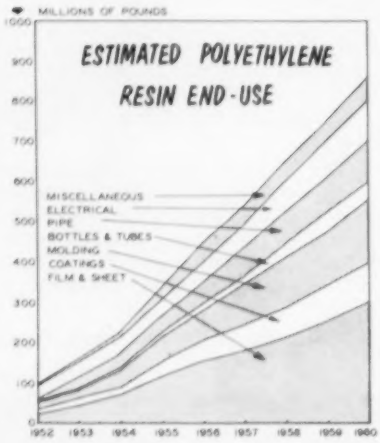
Consumption ready to grow . . . Consumption, Stringfellow estimates, will more than double in the next 5 years. It is expected to be 850,000,000 lb. in 1960, or 8½ times the total used in 1952.

Polyethylene capacity outstripped its market momentarily. But consumption is on the threshold of a big era of growth.

It wasn't until late 1953 or early 1954 that there was enough polyethylene to go around. This year is a different story. Plant capacity now exceeds consumption by 112,000,000 lb., reflecting the quarter-billion-dollar outlay for new plant the past 3 years or so. And that gap will spread, according to Stringfellow, until 1958 when capacity will stop growing to give consumption time to catch up.

What's behind growth . . . With plenty of polyethylene available, processors can now begin to exploit its potentialities without fear of a shortage.

Polyethylene has been improved and adapted to the point that it is superior



to other materials for packaging, molding, coating, some types of pipes, and other uses. This entire field is growing as more and more retail products are packaged. Polyethylene will take some markets away from inferior products, and also will share in new outlets opening up.

The greatest future appears to lie in packaging. Stringfellow foresees that more than half the polyethylene production will wind up as plastic bags, wrappings, tubes, and bottles. Bottles and tubes, however, have not taken as large a share of polyethylene as many experts predicted. Stringfellow continues to be conservative in estimating growth in this area.

Low-pressure polyethylene . . . Phillips Petroleum Co. was first out with the cheaper low-pressure catalytic process. The company is building a plant near Pasadena, Tex., to turn out the product for which greater heat and water vapor resistance, strength, toughness, and flexibility are claimed.

Hercules Powder Co. recently announced another low-pressure plant, based on the German-developed Ziegler process. Now a third plant has entered the fast-developing picture. This one will be built on the West Coast by Brea Chemicals, Inc., and Koppers Co., Inc., also using the Ziegler-type process.

These companies, along with such majors as Carbide & Carbon Chemicals Co. and du Pont, which are understood to be working on low-pressure processes, will pioneer the revolution in this segment of the petrochemical industry.

The plants already started are the forerunner of a second boom which is expected to see polyethylene become the giant among plastics—the first to reach a billion pounds per year in production (*The Oil and Gas Journal, May 9, page 80*).

Effect on ethylene . . . The polyethylene expansion, of course, also means ac-

Capacity and Consumption

(Estimated—Millions of pounds)

	Capacity (as of July 1 each year)			Consumption (for calendar year)		
Year—	High pressure	Low pressure	Total	High pressure	Low pressure	Total
1952	125		125	100		100
1953	135		135	160		160
1954	195		195	220		220
1955	452	<1	452	340	<1	340
1956	585	5	590	440	5	445
1957	585	145	730	500	35	535
1958	585	245	830	545	100	645
1959	585	245	830	595	150	745
1960	585	245	830	625	225	850

Note: Consumption includes reprocessed material.

Estimated Polyethylene End Use

(Millions of pounds)

Year—	*Total consumption	Film & sheet	Coatings	Molding	Bottles & tubes	Pipe	Electrical	†Misc.
1952	100	30	10	10	3	10	37	
1953	160	45	15	25	6	30	34	5
1954	220	70	25	35	7	40	34	9
1955	340	120	35	60	10	45	40	30
1956	445	155	50	80	15	55	50	40
1957	535	175	65	100	25	70	60	40
1958	645	210	80	120	35	80	75	45
1959	745	250	90	135	45	90	90	45
1960	850	300	100	150	50	100	100	50

*Includes reprocessed material. †Includes: low molecular weight, chlorinated, sulphochlorinated, copolymers, and exports.

companying growth in ethylene production. Competent estimates call for an increase in capacity to 2,000,000 tons by 1960—almost twice the 1954 figure. Much of this will supply the increased demand by polyethylene plants.

Present facilities are concentrated on the Gulf Coast. But Esso Standard Oil Co.'s announcement of an ethylene plant at Bayonne, N. J., may mean a trend toward getting the supply next door to chemical companies which will ultimately use it.

Most ethylene has been coming from byproduct refinery gas, augmented by the cracking of ethane and propane. Now Phillips is turning to normal butane as feedstock. The base could be broadened still further to include commercial L.P.G., natural gasoline and light refinery fractions, and crude oil (distillate fractions) as feedstocks, although gas oils and residuals are not economically attractive in the United States.

Sale Record Set

Sinclair pays $6,217 per acre for Texas U. lease

AUSTIN.—Sinclair Oil & Gas Co. reached deep in its pocket here last week to pay the highest per acre price in history for an oil and gas lease on University of Texas lands.

The company offered a flat $1,000,000, or $6,217.74 per acre, for a 160.83-acre tract between the Emma and Triple N Ellenburger pools in Andrews County, West Texas.

Sinclair's bid highlighted a lease auction which netted $7,001,000. It boosted to more than $128,000,000 the total cash collected for the university's permanent fund from such sales.

All but one of the four drilling blocks up for auction were relative bargains at the selling price. That one, a 1,969.3-acre tract in northeastern Crockett County, went to Ada Oil Co. for $420,000. This was the second highest bid at the auction. The lease on Tract 128 calls for a 2,000-ft. test to the San Andres formation within a year.

Atlantic Refining Co. offered the top bid of $11,000 for Tract 57, a 2,617-acre drilling block in southwestern Reagan County. This lease calls for a 9,300-ft. test to the Devonian.

Tract 71, 1,283.01 acres with a 3,000-ft. wildcat requirement, went to Stanolind Oil & Gas Co. for $70,000. Roger B. Owings, Fort Worth, made the top bid of $70,000 for a 2,639.13-acre block in Pecos County just west of Taylor Link pool. This lease, Tract 132, requires an Ellenburger wildcat to 7,000 ft.

WATCHING WASHINGTON

Bertram F. Linz

Oil Taxes Top $1 Billion

Revenues from the four federal oil taxes topped the billion-dollar mark for the first time in fiscal 1955.

At the close of the year the Treasury had counted $1,085,617,000 from these sources. But there were additional funds which had not been recorded, under the new accounting system adopted at the beginning of the fiscal year. The actual total collections for the preceding fiscal year were $952,620,000.

The figures showed that the oil industry was in a healthy condition. But they also emphasized that the oil taxes were held at their emergency rates when other excises were cut back in 1954. Whether they will be reduced next April 1, when another tax cut is due, is in the hands of Congress.

For the record, gasoline-tax collections hit $946,985,000 in 1955, up from $836,892,000 in 1954, with another $1,020,000 received from the one-half cent floor stocks tax. Receipts from lubricating oils were $69,559,000 against $68,029,000. The tax on diesel fuel brought in $24,767,000 against $17,969,000. And the expansion of pipeline traffic resulted in revenue of $43,286,000 from the 4½ per cent tax on transportation against $29,730,000.

Repeal of the excess profits tax, the reduction in individual income tax rates, the cuts in excise taxes, and the business set-back in 1954 combined to cut total tax collections by $3,631,000,000. But the Treasury still took in a healthy $66,289,000,000.

Gas Battle Warms Up

The big guns are being limbered up for the fight over the Harris gas bill.

The big battle will open in 4 weeks when Congress meets. But preliminary skirmishes already have occurred. Senate Majority Leader Lyndon Johnson of Texas said he would try to have the bill to exempt independent producers from federal regulation made an early "must" item of the session. Sen. Paul Douglas of Illinois, also a Democrat, said there'll be nothing doing if he can manage it.

Following the lead of the industry, which set up a committee last year to work for the bill, distributors have set up a council of local gas companies to work against it. The council has opened offices in Washington but plans to put most of its effort into a "grass-roots" campaign to sell the idea that the bill "could increase gas prices to consumers $800,000,000 annually."

If the bill comes up early in the session opponents may try to tie the Senate up in a filibuster. Douglas put it more politely. He said there is likely to be extensive debate and delay on other parts of the Democratic program.

The strategy will be either to load the bill with amendments the House will not accept or talk it to death on the floor of the Senate.

Wanted—More Scientists

Teaching of the physical sciences must be stepped up sharply if the United States is to be assured of an adequate supply of technical and scientific personnel for the industry of the future.

This was one of a handful of problems discussed last week by some 2,000 educators, businessmen, and others at a White House conference on education called by President Eisenhower. The meeting was sponsored by a presidential committee which is to make a final report to him next year, suggesting how our educational needs can best be met.

Today, Government and industry are spending more than $5,000,000,000 a year on research and development. More than 250,000 scientists and technicians are employed in this work. But there is a shortage of these workers now, and it is expected to get worse as industry calls for more and more professionals.

Studies by the National Science Foundation showed that a lack of experienced scientists and engineers already is handicapping research in the oil industry (*The Oil and Gas Journal, July 18, page 73*). More recent reports have warned that the U. S. is falling behind Russia in the training of scientific and technical personnel.

The outlook for the future is further darkened by the expectation that the spread of automation, now limited to a few major industries but offering possibilities for many others, will catapult the demand for scientists and technicians.

Little Producers—But They Add Up

State—	Number wells	Abandonments	Production bbl. 1954	Av. bbl. per well day, 1954	Prod. Acres	Reserves (1,000 bb'.) Primary	Secondary	Total 1-1-55
Arkansas	2,919	112	11,753,898	11.03	62,866	111,153	32,601	143,754
California	12,836	137	48,343,000	10.32	118,823	632,901	528,850	1,161,751
Colorado	181	35	538,918	8.16	11,620	36,026	.....	36,026
Illinois	25,692	468	71,365,000	7.61	494,480	695,849	*	695,849
Indiana	4,504	215	10,510,381	6.39	62,020	57,355	27,450	84,805
Kansas	23,733	972	41,730,036	4.82	624,370	229,025	181,025	410,050
Kentucky	16,233	250	4,500,000	.76	74,000	43,000	50,000	93,000
Louisiana	6,103	281	12 567,526	5.41	76,235	94,830	43,000	137,830
Michigan	4,169	147	12,043,558	7.91	135,420	60,762	10,800	71,562
Mississippi	207	5	583,885	7.73	8,210	2,291	.....	2,291
Missouri	120	.....	96,021	2.19	600	750	.....	750
Montana	3,022	19	4,650,250	4.22	41,980	19,207	63,825	83,032
Nebraska	71	2	211,439	8.16	1,400	1,700	.....	1,700
New Mexico	2,755	7	4,875,438	4.85	111,594	43,480	65,800	109,280
New York	24,200	.....	3,274,000	.37	52,363	29,000	62,200	91,200
North Dakota	7	.....	14,845	5.31	280	.....	.....	.....
Ohio	14,613	1,242	3,887,000	.73	118 000	36,772	7,000	43,772
Oklahoma	54,200	832	83,726,134	4.23	841,560	542,670	1,123,545	1,666,215
Pennsylvania	72,862	4,433	9,608,269	.36	625,211	33,000	418,587	451,587
Tennessee	36	.....	12,800	1.35	185	.....	.....	.....
Texas total	55,590	1,984	97,599,326	4.81	790,929	981,725	1,199,304	2,181,029
N. Texas	19,221	712	19,251,195	2.75	243,010	364,600	739,000	1,103,600
W. C. Texas	7,511	320	7,024,790	2.56	30,044	60,088	105,154	165,242
Texas, other	28,858	952	71,323,341	6.77	517,875	557,037	355,150	912,187
Utah	13	.....	7,996	1.68	260	.....	.....	.....
Virginia	12	.....	5,936	1.36	100	.....	.....	.....
W. Virginia	12,864	164	2,900,000	.62	209,360	40,594	52,340	92,934
Wyoming	3,334	13	7,690,240	6.32	48,122	34,408	121,250	155,658
Other	.....	.....	.....	.....	.....	†335	.....	†335
Total stripper wells	**340,276**	**11,318**	**432,495,896**	**3.48**	**4,509,988**	**3,726,833**	**3,987,577**	**7,714,410**
Total all wells	**‡499,509**		**2,277,095,000**	**12.49**	**8,600,000**			

*Primary reserve estimates include secondary recovery reserves of projects now in operation. †Primary reserves stripper wells in North Dakota, Tennessee, Utah, and Virginia. ‡Source, The Oil and Gas Journal.

Stripper Wells: A Bigger Role Ahead

SANTA FE, N. M.—Activity in the nation's stripper oil fields is showing marked gains.

The Interstate Oil Compact Commission reports production and potential of stripper wells have reached such a point they represent:

. . . **Sixty-eight per cent** of the nation's total producing oil wells.

. . . **One-fifth** of the nation's total oil production.

. . . **Thirty-eight per cent** of the total estimated secondary-recovery reserves.

That was the picture portrayed for the compact meeting here through its annual national survey of stripper wells for 1954. The study was made with the cooperation of the Independent Petroleum Association of America and the National Stripper Well Association.

The survey revealed the number of stripper wells increased 7,724 during the year. They were reported at 340,276 compared with 332,552 in 1953, and represent about 68 per cent of the nation's 499,509 oil producers.

A stripper well is defined in the report as one which:

. . . **Produces less** than 10 bbl. a day, or

. . . **Is in a field** which has an average per-well production of less than 10 bbl. a day, or

. . . **Once was a stripper** well by the above definitions but is now producing more than 10 bbl. daily because of secondary-recovery operations.

Significance . . . Strippers represent a big chunk of the nation's oil production.

These marginal fields stepped up their production in 1954 by 51,548,648 bbl. over the output in 1953. Total stripper production for the year was 432,495,896 bbl. out of a total U. S. production estimated by the compact at 2.2 billion barrels.

The compact study attributed this sharp rise to three developments:

. . . **Water-flood** operations.

. . . **Gas-injection** projects.

. . . **More wells** in stripper category plus fewer abandonments.

Stripper Well Gains

	1953	1954	Change
Stripper wells	332,552	340,276	+ 7,724
Abandonments	13,278	11,318	— 1,960
Stripper production	380,947,248	432,495,896	+ 51,548,648
Average bbl. day per well	3.14	3.48	+ 0.34
Stripper acreage	4,475,790	4,509,988	+ 34,198
Primary reserves	3,983,326,000	3,726,833,000	—256,493,000
Secondary reserves	3,286,855,000	3,987,577,000	+700,722,000
Total reserves	7,270,181,000	7,714,410,000	+444,229,000

The total amount of water-flood production in the U. S. during 1954 was estimated by the compact at 118,000,000 bbl. The major portion of this was produced from the stripper fields.

In addition, an estimated 20,000,000 bbl. was produced from secondary-recovery gas drives.

Only 11,318 stripper wells were abandoned during the year compared with 13,278 the year before.

The net result was an increase in the average production per stripper well from 3.14 bbl. daily in 1953 to 3.48 bbl. in 1954. Average production from the nation's other oil wells is 12.49 bbl. daily.

What's potential? . . . The total reserves represented by the stripper oil fields are 7,714,410,000 bbl.

Almost 4,000,000,000 bbl. of this can be recovered only by use of secondary methods. The primary reserves total 3,726,833,000 bbl. The study said this represented slightly more than 10 per cent of the nation's estimated 35,000,000,000 bbl. liquid hydrocarbon reserves. The stripper secondary reserves represent about 11.5 per cent of the total. They also are 35 per cent of the estimated 11,527,000,000-bbl. secondary-recovery reserves of the nation.

Crude Price Hiked

Penn Grade postings raised for fourth time this year

BRADFORD, Pa.—Pennsylvania Grade crude prices moved up for the fourth time this year on December 1.

The latest increase—10 cents a barrel—puts prices about 50 cents a barrel above a year ago.

The Joseph Seep Purchasing Agency for South Penn Oil Co. said that the continued increase in demand for Pennsylvania Grade crude justified the higher prices.

The new postings for South Penn are: Bradford, $3.85; Middle District, $3.72; Southwest Pennsylvania, $3.43; and West Virginia, $3.31.

Quaker State Oil Refining Corp. reported an increase of $0.10 per barrel for Buckeye crude to $3.25.

Pennsylvania Grade prices have climbed steadily since September last year. On September 1, 1954, Bradford crude was selling at $3.23 a barrel. New postings since that time have been: $3.35 on December 1, 1954; $3.50 on January 21, 1955; $3.60 on July 11; $3.75 on November 1; and $3.85 on December 1.

Simple forms sought as . . .

Oil Men Fight Red Tape

Henry D. Ralph

SANTA FE.—Oil and gas operators will cheer this: A move has been launched for a simple, standard report form for all state regulatory agencies.

The question was taken up by the regulatory practices committee of the Interstate Oil Compact Commission in a meeting here last week.

Discussions revealed the number of forms used by the states varies from a low of 4 to a high of 29. Several states require 20 or more forms. No two use exactly similar forms for essentially the same information, although often one commission will accept the form used by a neighboring state.

New trend . . . Sentiment among regulatory bodies represented on the committee was unanimous that a start should be made toward more uniform reporting methods. This is urgent particularly since many companies are now keeping their own records on punch cards and several state commissions are considering machine tabulation.

Company representatives present said that uniform reporting methods would save them thousands of man-hours in record keeping and in reeducating personnel on local procedure whenever a man is transferred from one state to another. Several expressed hope that the industry could standardize its own record keeping at the same time, though some felt that this might be even more difficult than getting agreement among the state bodies.

Many companies require more information on field operations for their own use than is required by most of the states in which they operate. It was suggested that perhaps a model set of forms could be drawn up which would be acceptable to a number of large operators and to several of the state commissions. These could then be adopted on a voluntary basis. Information not required or needed could be omitted without affecting the uniform nature of the form.

Long process . . . It was agreed that standardization of statistical and operating reports will be a long process. It may never be complete due to differences in state laws and practices and in company procedures. But a start should be made with the monthly reports already required by many states.

To start the study, Chairman T. A. Morgan, of the Kansas Corporation Commission, appointed an industry advisory committee headed by O. P. Nicola, Jr., of Phillips Petroleum Co., Bartlesville. This group was instructed to obtain the regulations and report forms of all states in the compact and get industry opinion on how the problem should be approached.

Refinery Planned

Commerce Oil completing east coast plant details

PORTSMOUTH, R. I.—Commerce Oil Refining Co. expects to break ground here February 1 on a possible 45,000-bbl. refinery. Officials expect to complete negotiations for crude and processing agreements by the end of the year.

Lummus Co. is handling design work for the plant but so far has not firmed up details. Company representatives report the proposed crude capacity may be expanded from 30,000 bbl. daily to 40,000 or 45,000 bbl.

The plant will process Middle East crude and plant design will incorporate the full complement of modern processes for maximum gasoline production and quality. Both coking and Houdresid are under consideration for converting heavy residuals to distillate fractions. Catalytic reforming coupled with reformate extraction and reprocessing also is planned, along with catalytic hydrogen treating (*The Oil and Gas Journal, May 30, page 56*).

The company says it has cleared the financing hurdle. Once firm processing contracts are closed for products and the crude supply is committed, Commerce expects backers to complete capitalization on a lease-back form of agreement.

North Dakota Has Strike

BISMARCK, N. D.—North Dakota has a new oil field.

The discovery is Amerada Petroleum Corp. 1 Grimstead, located in McKenzie County 4 miles southeast of Keene field and 3 miles north of Blue Buttes field. It opened a new pool on the south end of the Nesson anticline, flowing 244 bbl. of oil daily from the Madison-Mississippian at 9,229-69 ft.

The 1 Grimstead, the state's sixth discovery for 1955, appears to be on the same structural trend as Blue Buttes, which also was opened this year.

Lea Gets New Pool

Devonian oil prospect near Jal flows on test

HOBBS.—Another Devonian oil discovery is keeping the exploration spotlight on Lea County, New Mexico.

The latest new-pool prospect is Delhi-Taylor Oil Co. 1 Federal-Cline, 12 miles north of Jal. The map shows its position in relation to other pre-Pennsylvanian producing areas.

On completion test, through ⅜-in. choke, the well flowed at the daily rate of 228 bbl. of oil. Gravity was 39.5°. The Devonian was perforated at 7,963-8,028 ft. Delhi-Taylor owns approximately 1,240 acres checkerboarded around the well.

First Devonian oil was added recently to the Crosby-Devonian gas area, south of Jal. Sinclair Oil & Gas Co. 1 Lanehart flowed 58,000,000 cu. ft. of gas a day, plus 120 bbl. of high-gravity oil.

Devonian oil on the northwestern flank of Fowler-Ellenburger field was opened by Stanolind Oil & Gas Co. This well found the Ellenburger barren, plugged back to the Devonian, and completed for 160 bbl. of oil through small-size choke.

Completion gage on Signal Oil & Gas Co. 1 Gulf-State, Devonian discovery between Denton and Knowles (Devonian) fields, was 360 bbl. of oil a day through ¼-in. choke. Gravity was 48.6°, gas-oil ratio was 1,260:1 and flowing tubing pressure was 1,275 psi.

Asphalt Refinery Planned

HOUSTON.—A 2,500-bbl. asphalt refinery will be constructed at Pasadena, Tex., by a newly organized firm, Texas Asphalt & Refining Co.

F. M. O'Connor, executive vice president, said contracts for engineering and construction will be awarded this month. The plant is to be completed during the second quarter of 1956.

The refinery will be built on property owned by General American Tank Storage Terminal. Cost is estimated at more than $1,000,000.

Texas Asphalt & Refining Co. has established offices in Houston. President is A. R. Matthews, Fort Worth. He was founder of Terminal Refining Co., Corpus Christi, and Allied Oil & Refining Co., St. Elmo, Ill. He and O'Connor, a Houston independent, also founded New Mexico Asphalt & Refining Co., which recently was acquired by the Malco Interests.

Rail Lands Sought

Northern Pacific's right to land grants questioned

HELENA, Mont.—Northern Pacific Railway Co.'s ownership of thousands of acres of land grants in Montana is being questioned. Another railroad, Union Pacific, already is embroiled in suits challenging its mineral rights.

Four suits have been filed in state district court here contending the land claimed by Northern Pacific has reverted to government ownership. Much of the land is in the Williston basin and other oil areas.

In the Union Pacific case, the railroad claims oil leases granted by land owners of former land-grant land are invalid. Union Pacific says it retained mineral rights on the land *(The Oil and Gas Journal, September 5, page 82)*.

The Northern Pacific suits were filed by four war veterans—Gene A. Picotte, Keith C. Morton, Robert E. Kuntz, and John W. Mahan—who seek to buy a section of the land in McCone County. Their attorney, Ralph J. Anderson, said the section involved is in the Williston basin and has been leased to Shell Oil Co.

The suits allege that in 1870 Congress granted the railroad alternate strips 10 miles wide along the right-of-way only for 5 years after the road was completed. Anderson contends the line was completed years ago and his clients are entitled to purchase the land under land and homestead laws.

The attorney told the court that the four plaintiffs had offered to purchase the section for $2.50 an acre, with each veteran paying $400 for a quarter-section. Anderson claims that although Northern Pacific has sold some of the granted land, it has refused to dispose of the disputed section.

Judges Victor H. Fall and George W. Padbury, Jr., each signed two orders directing Northern Pacific to sell the section of land to the four or show cause in court December 12 why it has not done so.

Industry Briefs

AUSTIN.—Gulf Oil Corp. has notified the Texas Railroad Commission that it will reduce its imports by 4,700 bbl. per day during the first quarter of 1956. Gulf said it is taking the action to conform with a request by the Office of Defense Mobilization for a 7 per cent cut in imports from certain areas.

REGINA, Sask.—Fluor Corp., Ltd., has abandoned plans to build a plant here through an affiliate, Prairie Pipe Co., Ltd., to make steel pipe for oil and gas pipelines. The company had planned a $3,500,000 plant capable of making 100,000 tons of pipe per year. But steel supplies for the project did not materialize.

AUSTIN. — Phillips Petroleum Co. will store ethylene and butane in underground salt caverns near its refinery at Sweeny, Tex. The Texas Railroad Commission approved the plan to use two 200,000-bbl. capacity reservoirs in the Clemens salt dome, Brazoria County. The Sweeny ethylene plant now under construction will feed Phillips' low-pressure polyethylene plant near Pasadena, Tex.

BATON ROUGE.—Louisiana's oil-production allowable for December has been set at 741,776 bbl. daily. This is 9,320 bbl. per day more than the November allowable.

VENTURA, Calif. — The city of Oxnard is taking more time to investigate Richfield Oil Corp.'s application to drill near the city limits. The Ventura County Planning Commission delayed a hearing on the petition until December 22. Richfield wants to drill a deep test on the Earl J. Ruggles ranch. Part of the lease is in the city limits, where drilling has not yet been authorized.

TOPEKA.—The Kansas Corporation Commission has set state's daily crude allowable for December at 335,000 bbl., an increase of 5,000 bbl. over November.

BEAUMONT.—Bethlehem Steel Co. has contracted to build a $2,500,000 drilling barge for Penrod Drilling Co. The self-contained unit will be capable of operating in open water 70 ft. deep. It will be 190 ft. long, 150 ft. wide, and 90 ft. deep and will contain quarters for a crew of 50 men. The big unit is scheduled to go to work for The California Co. following its delivery next August.

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We were the baby of the oil fields then. But babies have a way of growing up. Now there are 58 Bethlehem stores, all fully stocked for local needs, and they cover a lot of territory. They serve an area that extends from California to east of the Mississippi . . . and from the Gulf Coast to Canada.

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MISSISSIPPI
Laurel

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Artesia, Hobbs

NORTH DAKOTA
Tioga

OKLAHOMA
Bartlesville, Duncan
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Seminole, Wewoka

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WYOMING
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Gas Project Upset

Indignant North Dakota board wrecks Montana-Dakota plan to begin service to Minot, adds difficult requirements

MINOT, N. D.—Torchlight party postponed—no gas.

That was the unhappy situation for city officials here last week when Montana-Dakota Utilities Co. canceled plans to start gas service to Minot.

The company said it could not operate its new transmission line and distribution system under conditions imposed by the North Dakota Public Service Commission.

Montana-Dakota had scheduled start of service to Minot homes for last Monday. Civic leaders arranged for a torchlight ceremony last Wednesday to commemorate the occasion and celebrate a 25-year successful fight for the new fuel. The commission decision spoiled both plans.

The utility reportedly invested $5 million in building a 120-mile, 12-in. gas-transmission line from Williston to Minot through Tioga. It added another million in 50 miles of distribution lines in Minot.

The firm got a temporary Federal Power Commission permit for the pipeline from Williston to the Tioga plant of Signal Oil & Gas Co. but built the line from Tioga to Minot without certificate. The step was taken on advice of counsel as "strictly a business risk venture" *(The Oil and Gas Journal, October 24, page 69).*

Tough decision . . . But Montana-Dakota ran into trouble when it requested a certificate to operate the system. The commission approved the certificate—providing Montana-North Dakota agreed to these conditions:

. . . Extend the line 280 miles southeast of Minot to Fargo.

. . . Extend another branch 220 miles east to Grand Forks.

. . . Build a 115-mile lateral line to Bismarck to intersect the company's main transmission line in southern part of the state.

. . . Renegotiate purchase contracts with Amerada Petroleum Corp. and Signal to buy gas at no more than 12 cents per M.c.f. Contract price now is 16 cents, rising to 19 cents in 20 years.

. . . Amend or obtain new franchises from all cities along the line from Minot to Williston and post a $50,000 bond.

In addition the commission ordered Montana-Dakota officials to appear before it at Bismarck on December 29 for a contempt hearing. The possible contempt charge was based on the company's building the line before it had received a certificate.

Tangled affair . . . Montana-Dakota planned district court fight against the commission's orders but withheld service along the line pending a court decision.

The developments were the latest in a series of tangled events surrounding attempts to find an outlet for gas from Tioga and Beaver Lodge fields of North Dakota. The gas is processed by Signal's Tioga plant, which flares about 20,000,000 cu. ft. of residue gas daily. Amerada, which owns the dry gas, is using only about 3 to 4 million cubic feet daily in its field operations. It was gas from this plant that Montana-Dakota had agreed to purchase.

Elk Hills Up Again

Standard anxious to take its oil, get out of deal

WASHINGTON.—Congress next year may consider the 4-year-old fight of Standard Oil Co. of California to take its oil and get out of the Elk Hills Naval Reserve.

The issue came into the open again last week. It was disclosed that company officials and representatives of the Navy's Office of Petroleum Reserves discussed it with the Budget Bureau a month ago.

Standard offered the Navy a trade in 1951. It proposed to take its share of the oil in the shallow zone. In return Standard would give up its share of oil in the lower or Stevens zone. The company then would get out of Elk Hills entirely, leaving the Navy free to develop the whole reserve as a source of oil in the event of war.

What's at stake . . . Standard owns a third of the oil in the shallow zone and 20 per cent of that in the Stevens zone. A deeper reserve, the Carneros zone, was discovered 2 years ago, but it belongs entirely to the Navy.

Over a primary period, Standard received a good share of the oil produced. That period expired in 1951. Since then Standard has been getting 11 per cent of the output. The Navy gets about $15,000,000 a year from its 89 per cent share, and the way the field is being worked it could produce for another century.

Standard has raised its offer since 1951 when it offered a premium of 15,000,000 bbl. of oil for a quick workout of its interest. In 1954, it offered a larger amount of oil and a contribution toward developing the reserve for defense purposes. Value of the reserve is estimated at $1,600,000,000.

Congress' role . . . The Navy is as anxious as the company to end the joint ownership of Elk Hills, a department spokesman said.

But it has not been able to evaluate Standard's offer. It is baffled by a number of "unknowns," such as the rate of production to be fixed and the value of the oil in the future.

All developments have been made known to Rep. Carl Vinson of Georgia, chairman of the House armed services committee. Nothing can be done to change the present unit agreement with Standard without approval of the House and Senate committees. Any new agreement also would have to get approval of the Justice Department and be authorized by the President.

Vinson has disapproved of the proposal as it now stands. But he has not been asked to pass on any new arrangement. He is expected to go into the matter next session.

Navy Wants Rifle Plant

WASHINGTON.—The Navy may ask Congress next year to let it get into synthetic liquid fuels research.

The department would like to take over the oil-from-shale studies formerly made by the Interior Department at Rifle, Colo. That operation was closed down this year when Union Oil Co. announced it was going to get into shale research.

Navy experts believe that with an annual appropriation of $1,250,000 to $1,500,000 they could come up with a commercial-size retort and improved methods of mining the rock in 5 years.

Oil Found on Gas Dome

CRAIG, Colo.—First oil production on the Thornburg gas dome in Moffat County has been found by Continental Oil Co. and Sinclair Oil & Gas Co.

The 3-A Unit, located on the north flank of the dome in northwestern Colorado, flowed 78 bbl. of oil per hour through 2-in. tubing after fracture treatment. Perforations are at 4,260-4,382 ft. in the Weber-Pennsylvanian sand. The well flowed 134 bbl. of oil in 7 hours on ¼-in. choke. Testing is continuing.

Tight, easy valve closure every time after 4 years on 800° F. oil

THE CASE HISTORY—With no maintenance whatsoever in more than 4 years' continuous service, these Crane 300-pound steel gates show no loss of efficiency. Fact is, they look good for service indefinitely.

The installation is at Cities Service Oil Co.'s Ponca City refinery. The valves are on the hot oil outlet lines from a crude unit heater. Oil handled is 800° F.

While operated fairly frequently under high temperature, these Crane No. 33X valves show no effects from this severe service. They have provided tight closure with no leakage at any time—and with unfailingly smooth response to the handwheel.

Outwardly Crane steel valves may look like many others. But there's a big difference inside. For instance, in the extra skill and care that go into Crane Exelloy seating design and manufacture.

That's what makes these Crane valves such outstanding performers in refinery service.

In steel gates, globes, angles and checks, Crane gives complete selection—in sizes up to 24 inches—in pressure classes up to 2500 pounds. See your local Crane Representative for valuable help in specifying and ordering.

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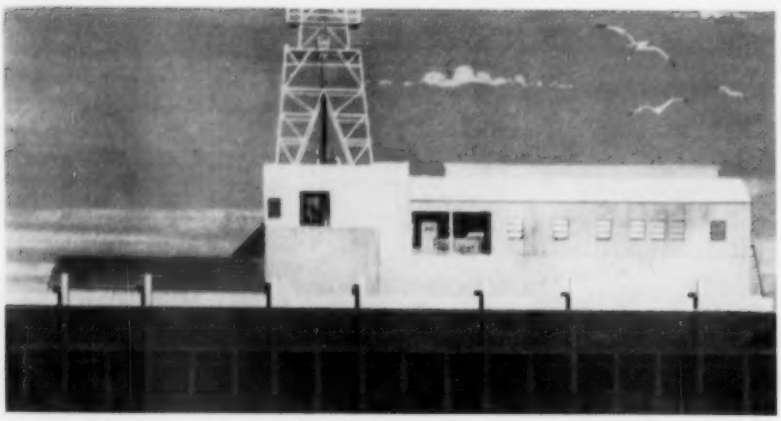

Magnolia to cut drilling costs . . .

. . . New Offshore Rig Designed

DALLAS.—A new offshore drilling technique born somewhat of necessity is going to save Magnolia Petroleum Co. a lot of money.

The company has acreage 2 miles out in Breton Sound near the mouth of the Mississippi, and it wanted to start a test early next year. The location is in relatively calm water, 24 ft. deep, in Block 46 of the Main Pass area 67 miles southeast of New Orleans.

The company normally favors self-contained platforms or those served by L.S.T. or Y.F. tenders. All of its tender vessels, however, were tied up, and Magnolia didn't want to spend a couple of million dollars or more to buy another.

A self-contained platform would probably have cost $750,000 to $800,000. In such shallow water such an expense didn't seem warranted.

Company engineers went to work on the problem and came up with the new offshore drilling idea.

Bird-on-a-nest . . . The company terms the result the "bird-on-a-nest" method. It will make use of a platform and of a conventional shallow-water drilling barge.

Whereas most platforms tower up to 50 ft. above the water level, the deck level of Magnolia's platform will be 8 ft. under water. Extensions from the underwater piling will project above the surface.

The drilling barge, used recently in the Galveston Bay and Lake Charles shallow-water areas but idle now, will be floated into place over the structure and sunk by taking on ballast. Sinking of the barge will wedge it tightly between the pilings to which the barge will be further secured with cables.

Although the deck of the barge when sunk will be only 4 ft. above the water level, Magnolia engineers say normally rough weather won't interrupt operations. All vital components of the drilling rig, such as the engines, are on substructures 12 to 15 ft. above deck level.

In case of more severe storms, the barge will merely be towed to a protected inland anchorage a few miles away. The company hopes to finish the test before hurricane season rolls around again.

If it produces? . . . Should the wildcat find commercial production, Magnolia expects to drill 3 to 5 directional wells. The barge then will move off location, and the underwater structure will be extended to 20 ft. above water level to hold production equipment. If no oil is found, the platform will be removed.

Magnolia thinks the "bird-on-a-nest" method will cut costs of the platform-tender or self-contained platform methods by more than half.

The company first off will realize a big savings in steel which would be required for a higher conventional platform. It will save a lot more since a tender won't be needed. Further, due to the compact drilling barge, less platform area will be required.

Contract for construction of the submerged platform has been let to Du Pont Fabricators of Calumet, La. The structure will be hauled to location and installed by Harvey Construction Co., Harvey, La.

Magnolia expects to be drilling by March 1, 1956.

Octanes Show Little Change

NEW YORK. — Octane numbers in the nation's gasoline continued virtually unchanged for the second month as the seasonal levelling-off extended into November.

Ethyl Corp.'s monthly survey reported premium-grade gasoline at a 96.1 research octane number and regular at 88.8.

These figures represent weighted national averages obtained from 850 gasoline samples purchased by Ethyl representatives in 53 U. S. marketing centers.

Only change from October was a 0.1 octane number rise for premium. Regular grade made no gain. The October figures showed no change in either grade over September's survey.

Tetraethyl lead content, however, declined from an average for premium to 2.59 ml. per gallon in October to 2.52. Regular dropped from 2.30 to 2.27 ml. per gallon during the month.

Premium trends . . . The octane plateau was not uniform in all cities.

Twenty-five showed monthly gains, two of them with more than 0.5 octane numbers for premium grade. The arithmetic averages of samples gathered within cities showed six cities with 97 octane or greater, compared with five in October. Top rating in November went to Pittsburgh with 97.2 as compared with an October high of 97.3 recorded in Atlanta.

Distribution on octane ratings by cities for premium grade was:

	Nov. 1955	Oct. 1955	Nov. 1954
90.7-90.9	1		3
91.0-91.9		1	4
92.0-92.9	1	1	8
93.0-93.9	3	3	11
94.0-94.9	9	9	18
95.0-95.9	14	18	8
96.0-96.9	19	10	1
97.0-97.3	6	5	
Total No. cities	53	53	53
Weighted avg. ON	96.1	96.0	94.1

Regular grade . . . Top rating in regular grade was also held by Pittsburgh, with an average of 91.5. The same city led in October with 91.2 and shared the top rating a year ago with Hartford and Philadelphia with 90.2 research octane number.

The distribution on regular grade follows:

	Nov. 1955	Oct. 1955	Nov. 1954
82.0-82.9	1	1	3
83.0-83.9	1	1	5
84.0-84.9		1	10
85.0-85.9	5	5	7
86.0-86.9	13	12	6
87.0-87.9	4	6	9
88.0-88.9	9	8	6
89.0-89.9	10	9	4
90.0-90.9	6	8	3
91.0-91.5	4	2	
Total No. cities	53	53	53
Weight avg. ON	88.8	88.8	87.1

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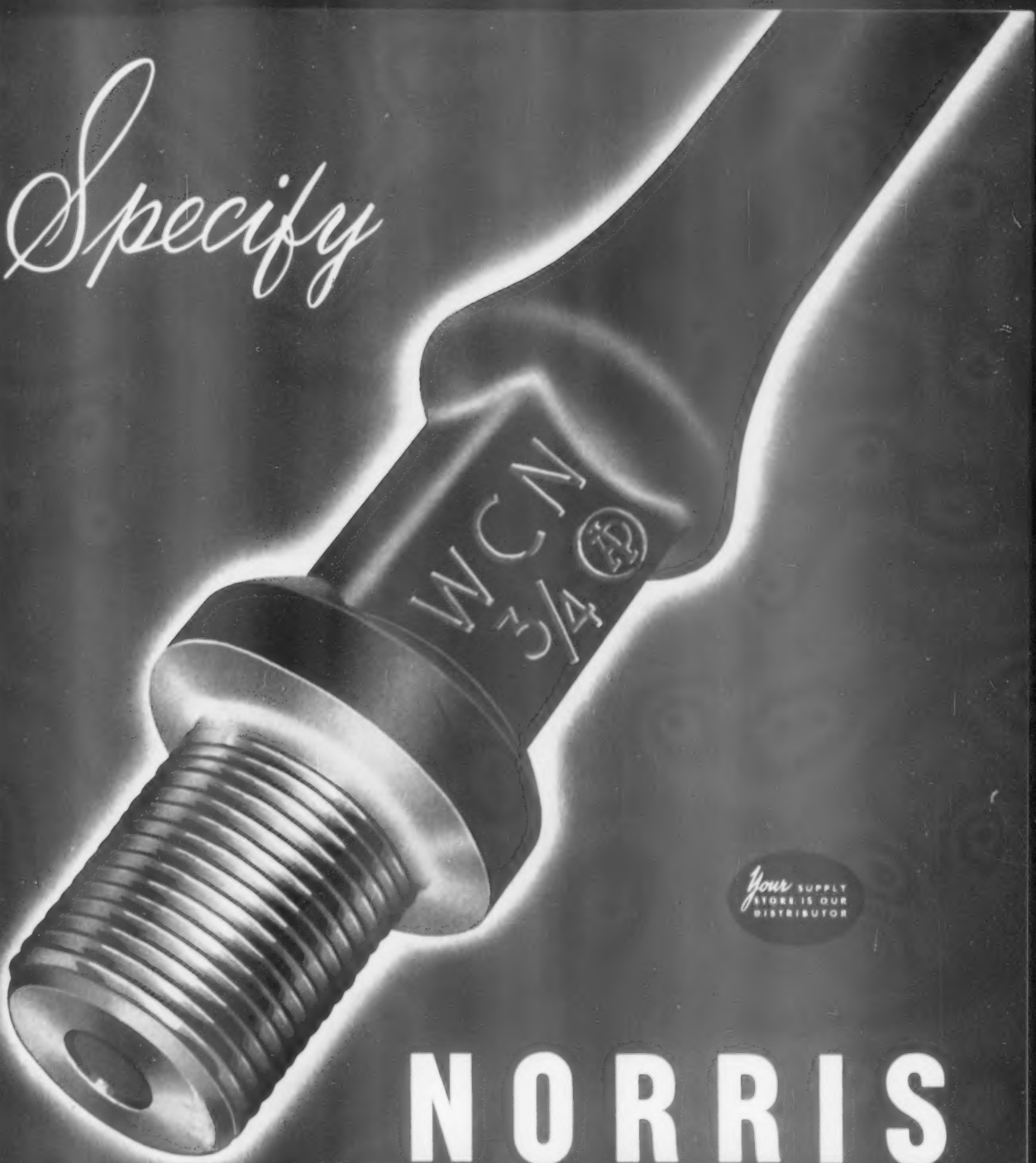

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Rules Tighter for WOC's

Businessmen in Government under Defense Production Act must walk tight rope to prevent "conflicts of interest"

WASHINGTON. — President Eisenhower laid down new rules last week on service by businessmen as unpaid employes or part-time consultants of federal mobilization agencies.

The rules are designed to give effect to restrictions written into law by Congress last session. They aim at heading off "conflicts of interest" such as have been brought out this year by congressional investigating committees. Such conflicts arise when a government official has to deal with matters affecting the company with which he was connected before entering the federal service.

The order applies only to employment under the Defense Production Act. The rules, therefore, would apply to oil men working for Interior or Defense Department mobilization agencies as WOC's or part-time consultants. But they would not apply to groups such as the National Defense Council, which was not set up under the act.

Tighter control over the employment of WOC's was ordered by Congress in the new Defense Production Act. The President's order extends the council to experts and part-time consultants hired under the authority of that law.

The order provides five rules to be followed:

. . . **Consultants and WOC's** shall be limited to advising government officials on matters involving policy.

. . . **They are barred** from making any recommendations concerning any firm in which they have a financial interest.

. . . **Agencies wanting to employ** a WOC or consultant must file a complete report on the work to be performed by the individual and explain why a regular government employe cannot do it.

. . . **Statements of the employing agencies** shall be published in the Federal Register.

. . . **Each WOC or consultant must file,** for publication in the Federal Register, a statement listing his connections with corporations, partnerships, and other businesses. The list must include the names of any corporation in which he owns any stocks, bonds, or other financial interest or did own within the preceding 60 days. A statement showing any changes in these interests must be filed every 6 months.

The President's order will be studied by the House judiciary committee. Chairman Emanuel Celler of New York has called Asst. Atty. Gen. Stanley N. Barnes to explain the order before his committee this week. Barnes, as head of the antitrust division, helped prepare the order.

Reef Pay Drilled

Heavy flow recorded in Hockley County wildcat

LUBBOCK.—A heavy flow of oil during the initial test of a Pennsylvanian reef section has focused attention of wildcatters on Hockley County at the northern end of the Midland Basin in West Texas.

The new prospect is Honolulu Oil Corp. 19-B Ellwood, 3 miles north of shallow production in Smyer pool. It also is 10 miles from similar reef oil in Ropes field.

A drill-stem test of the reef at 9,601-45 ft. flowed 105 bbl. of oil in an hour and 32 minutes of a 3-hour test. This was the first test of the section reported. Further details were not available.

The test is important because of its similarity to Ropes field, opened by Honolulu and Signal Oil & Gas Co. in 1950. A 150-ft. porous reef section in the discovery well produced a daily flowing potential of 2,236 bbl. through 1-in. choke. Potentials on development wells in Ropes field ranged as high as 2,900 bbl. daily.

Compact Asks Uranium Law

SANTA FE, N. M.—Legislation to permit an oil operator on federal lands to obtain a uranium claim if he makes a discovery while drilling or conducting seismic operations under an oil lease was requested by the Public Lands Committee of the Interstate Oil Compact Commission.

The proposal would allow an operator 90 days to file a mineral claim provided there were no prior mining claims on his lease. It was pointed out that under present federal mineral laws any individual may file a mineral claim if he has reason to suspect that uranium has been discovered in the course of exploration for oil.

R. & B. at 22,316

Deepest hole ever drilled going down 40 ft. per day

PORT SULPHUR, La.—The world's deepest well reached 22,316 ft. late last week and was drilling ahead in sand and shale.

Richardson & Bass was making about 40 ft. per day at the 1 LL&E Humble "L," with no immediate plans to stop drilling. It has already extended the depth record 834 ft. below the mark set by an Ohio Oil Co. well in Kern County, California.

Richardson & Bass tentatively plans to run an electric log at 22,500 or 22,600 ft. Cores have been recovered from below 20,000 ft. with good oil shows, raising the possibility this may also become the deepest producer ever drilled.

The test is 35 miles southeast of New Orleans in the Mississippi Delta marshes. In the venture with Richardson & Bass are John Mecom, Houston independent, and Freeport Sulphur Co., Houston.

P.G.&E. to Loop Big Line

SAN FRANCISCO.—Pacific Gas & Electric Co. has petitioned the California Public Utilities Commission to approve a $20,686,000 pipeline looping program. P.G.&E. cited a 37 per cent increase in gas requirements over its territory since 1950 as the basis for the expansion.

The proposed project involves laying 149.6 miles of 34-in. pipe paralleling P.G.&E.'s super-inch transmission line from Topock, Ariz., to Milpitas, Calif. Compressor capacity at three stations along the line also would be increased by 9,260 hp.

The additions will permit a 25 per cent increase in the utility's daily volume of gas deliveries. It also will mean that all but 70 miles of the 502-mile carrier will be looped.

P.G.&E. currently is importing 700,000,000 cu. ft. of gas daily from New Mexico and Texas fields. This is about two-thirds of its total requirements.

World Output Hits Peak

Crude oil production reaches all time high in free world in September; every exporter except Kuwait makes gains

Ray G. Gibson

CRUDE-OIL production in the free world outside the United States rose to an all-time high of 6,993,700 bbl. daily in September.

The record output contrasted to the usual trend for the month. In 1953-54, September was the final month of seasonal decline before new production records were set in fall and winter. Output for the month had not set a foreign production record since 1950.

The record still stands even if production in Austria, recently given up by Russia, is discounted.

Output in the United States increased by 66,000 bbl. daily over August to 6,731,000 bbl. daily, the highest since May. This brought free world total output to 13,724,700 bbl. daily.

Middle East . . . Only one of the major exporting countries showed a decline during the month. It was Kuwait, where output of 1,016,500 bbl. daily was down 29,700 bbl. daily from August, and off 79,700 bbl. daily from 9-month average.

On the other hand, production by Iraq Petroleum Co., Ltd., and its subsidiaries was at a new high. Output of 728,800 bbl. daily, including small production from a British Petroleum Co., Ltd., field, was up 6.4 per cent over the 9-month average of 685,000 bbl. daily. Most of the increase came from a record flow of 176,400 bbl. daily from Zubair and the newly developed Rumaila field, operated by Basrah Petroleum Co.

In other Middle East countries, Iran had its highest production since the beginning of consortium operations, 377,000 bbl. daily. Saudi Arabian production rose 2 per cent over August to 959,200 bbl. daily. This compares with the 9-month average of 945,300 bbl. daily. Qatar was another country with record production, 117,300 bbl. daily.

In Venezuela, output rose 14,000 bbl. daily to achieve the second monthly record in a row. The average of 2,183,600 bbl. daily was up 59,500 bbl. daily from the January-September average of 2,124,100 bbl. daily.

Egypt adds fields . . . In Egypt, two new fields came into production during the month. They were Belayim and Feiran fields, located in the southwestern section of Sinai Peninsula. Belayim produced 1,900 bbl. daily and Feiran 300 bbl. daily for a combined output of 2,200 bbl. daily. Southern California Petroleum Corp. is operating the field. The company is a minority interest holder in International Egyptian Oil Co., which holds the concessions.

Six wells were producing in Belayim and at least three in Feiran in September. Production is expected to reach 10,000 bbl. daily by the end of the year.

International Egyptian is the second company with production in Egypt. Anglo-Egyptian Oilfields, Ltd., jointly owned by Royal Dutch-Shell and Socony Mobil Oil Co., Inc., operates five fields. Their total output in September was 34,100 bbl. daily.

In Mexico, the expansion program of Petroleos Mexicanos was temporarily set back by 6 weeks of storms in September and early October. September output averaged 235,300 bbl. daily, off 13,500 bbl. daily, or 5.7 per cent from the August level.

TREND OVER LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total non-Communist countries
1954—			
September	2,697.7	2,705.9	5,903.3
October	2,750.0	2,898.6	6,141.6
November	2,856.5	2,844.6	6,193.6
December	2,975.7	3,001.8	6,453.3
1955—			
January	3,001.5	2,950.1	6,442.5
February	3,050.4	3,109.3	6,653.8
March	3,036.0	3,247.9	6,775.8
April	2,981.6	3,327.6	6,805.9
May	2,932.1	3,287.4	6,718.8
June	3,019.7	3,201.6	6,720.9
July	3,092.7	3,275.8	6,872.1
August	3,140.4	3,243.0	6,978.2
September	3,131.8	3,263.3	6,993.7

CRUDE-OIL PRODUCTION
(Daily average in thousands of barre'ls)

Country—	Sept. 1955	August 1955	Sept. 1954
W. Hemisphere:			
Argentina	84.3	84.3	80.6
Bolivia	8.4	8.4	5.4
Brazil	5.4	5.4	3.0
Canada	367.0	382.0	295.5
Chile	8.1	7.5	5.0
Co'ombia	111.4	108.6	105.2
Cuba	0.9	1.0	0.1
Ecuador	10.0	10.0	8.5
Mexico	235.3	248.8	230.9
Peru	47.6	46.8	46.4
Trinidad	69.8	68.0	64.3
Venezuela	2,183.6	2,169.6	1,852.8
Total	3,131.8	3,140.4	2,697.7
Western Europe and Africa:			
Algeria	1.1	1.1	1.3
Austria*	70.0	70.0	
France	21.0	20.7	4.6
Fr. Morocco	1.9	1.9	2.4
West Germany	63.9	63.2	54.2
Italy	5.3	5.1	1.4
Netherlands	20.0	19.4	18.7
Egypt	36.3	34.0	37.3
United Kingdom	1.2	1.2	1.2
Total	220.7	216.6	121.1
Middle East:			
Bahrain	30.1	30.1	30.1
Iran	377.0	354.0	35.0
Iraq	728.8	724.7	644.5
Kuwait	1,016.5	1,046.2	931.0
Neutral Zone	28.0	26.0	24.7
Total	3,263.3	3,243.0	2,795.9
Qatar	117.3	115.4	97.3
Saudi Arabia	959.2	940.2	941.9
Turkey	6.4	6.4	1.4
Other Asia:			
British Borneo	110.0	110.0	99.7
Burma	4.0	4.0	4.2
India	7.5	7.5	7.0
Indonesia	236.0	236.0	243.4
Japan	6.3	6.3	5.6
New Guinea	8.2	8.5	13.5
Pakistan	5.9	5.9	5.2
Total	377.9	378.2	378.6
Total, non-Communist foreign	6,993.7	6,978.2	5,903.3
United States	6,731.0	6,665.0	6,150.5
Total Free World	13,724.7	13,643.2	12,053.8
Communist Controlled Countries:			
Russian Occupation Zone of Austria*			60.0
Romania	125.0	125.0	120.0
Russia	1,260.0	1,260.0	1,185.0
Others	36.8	36.8	36.8
Total	1,421.8	1,421.8	1,401.8
World total	15,146.5	15,065.0	13,455.6

***Austria took over its producing fields from Russia in August 1955. Its production since then is listed with free world countries. Earlier output is carried under Communist Controlled Countries.**

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Other Communist includes China and Yugoslavia as well as the Soviet satellite countries in Europe.

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Bolivia Speeds Expansion

Government oil company steps up its own drilling program; at same time other areas are opened to foreign operators

Paul Swain

BOLIVIA, the only country in the world that has been able to meet its petroleum needs through government development, is ready to start an expanded drilling program on its own and at the same time throw open the country to foreign capital.

Four new rotary rigs purchased in the United States are due in Bolivia this week. The four new rigs will be used by Yacimientos Petroliferos Fiscales Bolivianos, the government company, for both development and exploratory drilling. Y.P.F.B. now has seven rigs drilling.

Two of the four new units were purchased from Cardwell Manufacturing Co., Wichita, Kans. One is rated to 5,000 ft. and the other to 8,000 ft. The other two were shipped by Continental Supply Co., New York. Both are 8,000-ft. rigs.

One is slated to test the new El Toro structure discovered by Y.P.F.B. in the Bermejo area on the Bolivia-Argentine border; one will go to Itapirenda in the Camiri area; one to Beuna Vista, about 3 miles southeast of Camiri; and the fourth will be used in development drilling in the Camiri field.

The new law . . . Just last month the country threw open its door to foreign capital on the usual concession basis for the first time since 1937 when foreign properties were expropriated. Before the passage of a new oil code, the country had attempted to interest outside operators in acquiring drilling leases from Y.P.F.B. With the exception of the deal made by Glenn McCarthy, Houston independent, for an area at Los Monos, this was unsuccessful.

Under the new code signed October 26 by President Victor Pas Estenssoro, applications for concessions in Bolivia can be made late in February of next year. The new law reserves the southeastern corner of the country for Y.P.F.B. for development, but throws the remainder of the country open to development.

The new law provides for two types of concessions in the three zones of the country open to private companies. They may be exploration concessions with later development rights, or outright development concessions for a 40-year period. The usual 50-50 profit split applies.

No oil discovered under terms of the new law would go to domestic Bolivian markets. Those markets are reserved for Y.P.F.B., unless the domestic demand should surpass Y.P.F.B. production. In this case the government can require private companies to furnish a pro rata share of local requirements.

At the present time, Y.P.F.B. is not only supplying Bolivia's domestic needs of more than 5,000 bbl. daily, but also is exporting oil to Argentina, Chile, and Brazil.

New Areas Opened

U. S. firm granted four concessions in Libya

LIBYAN AMERCIAN OIL CO., wholly owned subsidiary of Texas Gulf Producing Co., is the third foreign oil company to be granted concessions in Libya under terms of the country's new oil law.

Libyan American was organized last summer by Texas Gulf, with headquarters in Houston. Terms of the concessions provide that the company will pay 12½ per cent royalty on any oil production developed until the total output reaches 15,000 bbl. daily. After that, the government will get 50 per cent of the net income from the concessions.

Two of the exploration areas are near the foot of the Gulf of Syrtes, and the other two are in Cyrenaica.

First test on the acreage will be drilled by a contractor, probably to about 10,000 ft., a company spokesman said. Site has not been selected.

Standard Oil Co. (N. J.) and Cie. Francaise de Petroles were the first two companies granted concessions *(The Oil and Gas Journal, November 28, page 66).*

Syria Wins Transit Fee

Syria will receive the equivalent of nearly $20,000,000 a year in royalties for allowing Iraq Petroleum Co., Ltd., to move crude from its prolific Iraq fields across Syria by pipeline to eastern Mediterranean ports.

The agreement reached last week by I.P.C. officials and Syrian authorities ends a 3-year dispute over the oil transit payments.

In addition to the sliding-scale annual payment, the agreement provides for the equivalent of another $23,800,000 to be paid Syria on a retroactive basis.

Abdulwahab Haumad, Syrian finance minister who announced the agreement, said his government will ask Trans-Arabian Pipe Line Co. to open negotiations for increased payments also. Tapline crosses both Jordan and Syria moving crude from Saudi Arabian fields to the eastern Mediterranean at Sidon, Lebanon. Tapline now pays Syria a flat fee equivalent to $1,250,000 a year.

Concessions Sought

Guatemala is checking 91 requests, plans hearings

THE Guatemalan Government is studying 91 applications filed last month by 29 groups for exploration concessions, Ambassador Cruz-Salazar announced in Washington last week.

The period for filing ended November 23. The eligibility of the applying companies will be decided this week. After that, the government will set dates for hearings on conflicting applications. The hearings are expected to start immediately after Christmas.

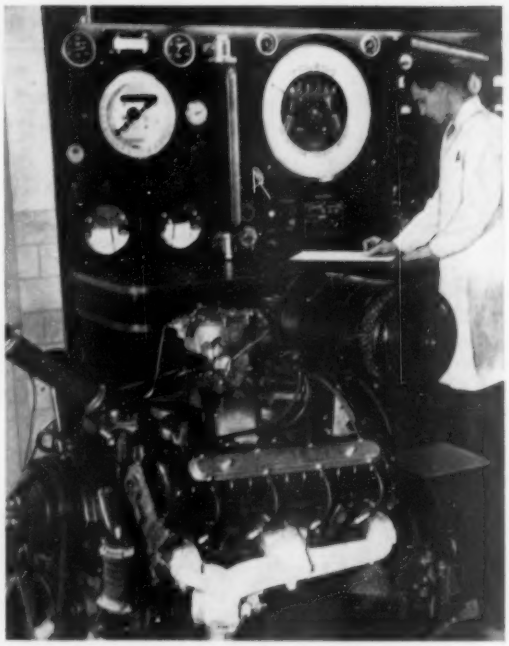
The new Guatemalan petroleum code provides that a company may hold not more than 400,000 hectares in exploration divided among not more than 10 rights. Two of the 29 groups filed for the maximum number, one filed for 8 rights and a fourth asked for 6.

The areas covered by the individual filings were not immediately identified, but it was indicated there are a number of conflicting applications. In resolving these conflicts all applications will be treated equally under the code, Cruz-Salazar said.

Who filed . . . The maximum of 10 rights was asked by A. K. Swan and Garfield & Pasternak. California Exploration Co. applied for 8 and Pequa S.A. for 6. Applications for 4 rights were filed by Union Oil Co., Signal Oil Co., Story J. Sloane, the Mallis Group, Halbert & Jennings, Seaboard Exploration, Shawano Development Corp., and Archer Oil Co.

Other groups filing applications were Standard Oil Co. (Ohio), Esso Standard Oil Co., Norman Texas Co., and Ohio Oil Co., each for 3 rights; Amerada Petroleum Co., Sun Oil Co., Texas Petroleum Co., each for 2 rights; and Atlantic Refining Co., Tide Water Associated Oil Co., Continental Petroleum Co., Atlas Petroleum Co., Bandini Petroleum Co., Central American Oil & Gas Co., Petroleum (Investment) Shell, Guatemala Iquam S.A., Jaime Willard, Antonio Molini, and Cia. Petrolera Guatemalteca, each for 1 right.

Recently seven experimental fuel additives were tested in a fleet of passenger cars under severe conditions. Tests showed that four of the additives reduced exhaust valve life, whereas three actually increased it 25% to 50%. In another make of car, under the same conditions, not one of the additives had any effect on valve life. It's small wonder such a great amount of experimental effort goes into durability testing.



Most durability testing of new additives must be conducted in multicylinder engines. Priority is given to operation of these engines in the laboratory rather than on the road because it is easier to maintain close control of test conditions.

Engine durability testing for new additives

By R. V. KERLEY
Ethyl Corporation, Detroit, Mich.

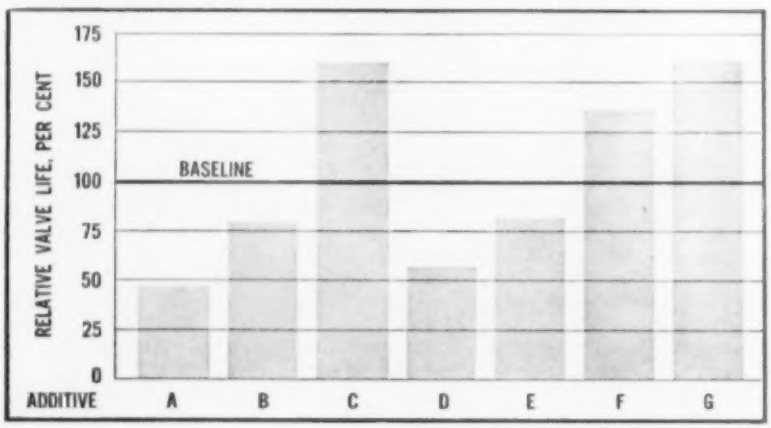
As THE TREND to higher compression engines has continued, many additives have been developed to meet new requirements. Scavengers have been designed to increase exhaust valve life, and additives developed to inhibit rusting, to increase fuel stability, and to prevent carburetor icing. Other additives have been developed to suppress spark plug fouling and deposit-induced surface ignition. Undoubtedly, new additives will be discovered to supplement or replace many of those currently in use.

Durability testing vital

Development of any new additive requires a great deal of testing before the product can be marketed with the assurance that it will be beneficial to all users. From past experience it has been found that much of the total development effort must be spent on the durability aspects of the additive. That's because very small concentrations of different chemicals may either improve or drastically reduce engine durability as shown in Figure 1. In some cases it has been shown that as little as one gallon of additive in 50,000 gallons of fuel may reduce exhaust valve life to half of normal. On the other hand, increased amounts of the same additive may actually double normal life (Fig. 2).

Of course, a great many factors other than valve life must be considered in establishing the commercial possibilities of fuel additives. For instance, an additive's effect on engine wear, exhaust valve lash loss, combustion-chamber deposits, fuel economy, oil economy, the exhaust

FIG. 1. Effect of seven fuel additives on exhaust valve life.



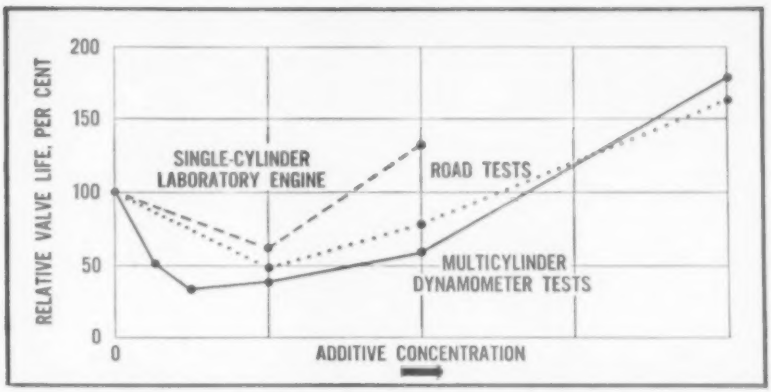


FIG. 2. Effect of full additive concentration on valve life with three different engines and different operating conditions.

system and even rear-bumper corrosion from exhaust products. If an additive registers a marked adverse effect on any of these important factors, it must be eliminated from further consideration.

Durability testing tools

Tools available for use in durability problems are generally put in the following order: (1) Chemical laboratory tests (2) Single-cylinder engine tests (3) Multicylinder engine laboratory tests (4) Fleet tests.

Chemical laboratory tests. These tests will generally supply all the needed information concerning the effect of additives on fuel storage stability, metal corrosion, and deterioration of rubber-like parts.

Single-cylinder engines. The Ethyl Corporation uses single-cylinder engines for preliminary testing of additives for positive and negative effects on valve durability. These engines permit close control of test conditions, require relatively small quantities of precious experimental materials frequently required. However, single-cylinder engines never act exactly like multicylinder engines. So the results from single-cylinder engines are regarded only as indications of durability effects until the data are substantiated by multicylinder engine tests.

Multicylinder laboratory tests. Most of the durability effort must be conducted in multicylinder engines. Therefore, in most laboratories, scheduling gives priority to operation of these engines in the laboratory rather than on the road. There are two reasons for this preference: In the lab you can maintain closer control of engine test conditions and since these tests are generally considered more reproducible, fewer tests are necessary to separate promising materials from those giving less satisfactory results.

Fleet tests. Final step in the development of the additive is to test it with vehicles on the road. This step is important for two reasons. It acts as a check on the conditions chosen in the laboratory tests and it provides results which are much more acceptable to the purchaser of the product.

Obviously, no single test or any group of tests on a single engine should be used to predict the effect of additives on engine durability. Thousands of hours of dynamometer testing and millions of miles of road performance in a wide variety of engines must be conducted before a company can be sure its new product will benefit the user. And even after extensive testing has been done, sound judgment based on experience and knowledge must be exercised.

Send for a reprint of our technical paper entitled "Fuel Additives and Engine Durability." It will give you the philosophy of durability testing, choice of test equipment and actual test schedules used. Address your request to Box 11, Ethyl Corporation, 100 Park Ave., New York, N. Y. No charge.

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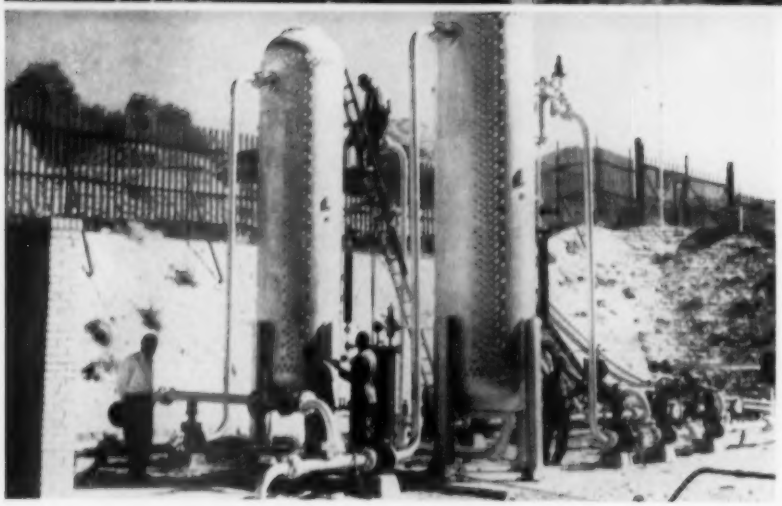

A NEW JETTY is under construction at Bandar Mashur, top photo, as part of the rebuilding program in Iran. The jetty will be completed early next year. It will be the fourth for the port. The third was completed this year. Bandar Mashur can handle 50 tankers a month and will be able to handle as many as 90 as soon as expansion projects are completed.

GAS SCRUBBERS have been insta led at the new Tembi power plant in Masjid-i-Sulaiman field, left photo. Gas from these units feeds into two gas turbines of 4,500 kw. each to provide electric power.

Iran Is Rebuilding with Her Oil Revenue

● But economic recovery won't solve all the problems in Iran . . . the Iranians aren't convinced yet that they will profit more by letting foreigners run their oil industry

Paul Swain

This is the fourth and final article in a series on Iran's oil operations under the consortium. The previous articles appear in the November 7, 14, and 28 issues of the Journal.

OIL is the keystone of Iran's economy and when oil money was withdrawn during the 3-year nationalization, the structure almost collapsed.

The two operating companies of the international corsortium are doing a lot to put that economy back on an even keel, but a settled and even expanding economy isn't necessarily the answer to all problems.

The anti-British feeling that culminated in 1951 with the expulsion of Anglo-Iranian Oil Co. (now British Petroleum) did not develop overnight. Nor has the settlement agreement of a year ago magically dispelled the anti-foreign rallying c r y of Mossadegh's emotional followers. The Americans, French, or Dutch could easily replace the British as the target of Iran's nationalistic elements. In fact, this has already happened to some extent as far as Iran's press is concerned.

Iran's politics are turbulent. Emotion rather t h a n reason sometimes rules. Two weeks ago a Moslem fanatic wounded Premier Hussein Ala in an assassination attempt. The pro-Western premier was only slightly injured, but the shooting took place in the same mosque in central Teheran where a former premier, Gen. Ali Razmara, was killed by a religious fanatic in 1951.

The nationalization of Iran's oil industry was a miserable failure from an economic standpoint, but the whole idea appealed to the Iranian's nationalistic pride. If the situation is to be stable, the average Iranian is going to have to be convinced that the country's oil in-

Years of trouble free service

ORBIT'S

POSITIVE SEATING
POSITIVE STEM PACKING

The Orbit Valves in this installation have given years of trouble free service.

Positive shut-off has been maintained during all these years. The Plastic Stem Packing has never had more than a single, simple adjustment.

The Plastic Stem Packing used in Orbit Forged Steel Production Valves has low friction characteristics, which prevents stem seizure and does not interfere with the ease of operation for which Orbit Valves are designed. The selected lubricants resist the solvent action of line fluids to give long, trouble free packing performance.

No. 300 Plastic Stem Packing used in Orbit Forged Steel Valves is positive in its seal, safe and cannot be tightened unevenly.

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(FOR OVER FORTY YEARS)

EIGHT PIPELINES move crude from big Agha Jari field to Bandar Mashur.

NEW HOUSING, as we'l as refinery and field work, is part of the picture in Iran. These housing units for Iranian workers are going up at Bahar near Abadan. The consortium plans to build 800 units in 1955-56.

dustry is being operated to the best interests of not only Iran, but the average Iranian.

The Iranian isn't the least bit concerned about the international oil companies involved.

In dollars and cents . . . In this respect the consortium has what should be a satisfying story to tell in terms of money to the Iranian Government and to the Iranian people.

Almost $75 million from oil flowed into the Iranian treasury during the first 11 months of the consortium's operation. Iranian Oil Participants, Ltd., says a conservative estimate for the Iranian year ending in March 1958 would increase this to almost $188 million for that year. The latter figure is equal to Iran's entire national budget at the present time.

I.O.P. has revealed some other detailed figures regarding Iran's financial benefits, both direct and indirect.

During the Iranian year which ends next March, the government and National Iranian Oil Co. will get more than $102 million. Included in this figure are royalty payments, income taxes on trading companies set up by the participants and the operating companies, taxes on salaries, and custom duties.

Another $57 million-plus will be paid to the nearly 50,000 Iranians employed in the industry for salaries and wages and in payments to the social insurance fund. In the same period another $8,400,000 will be spent in Iranian markets and in payments to Iranian contractors.

This rather tidy $168 million filtering throughout the general Iranian economy is bound to make itself felt.

The future . . . One very profound influence on the future success of the entire consortium operation in Iran is one over which it has no control whatever—the government's economic development program.

This program could be the most tangible way to show the Iranian people what its oil industry can do for it. The program is financed with oil revenues. It's a little hard to convince a ragged Iranian living in a miserable mud hut, or worse, and scrambling for food that the money from his country's foreign-operated oil industry is going to benefit him some time in the future.

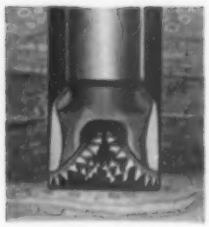
The two consortium operating companies are doing a great deal in a concrete way to improve the lot of the estimated 200,000 Iranians supported by the industry. But their efforts at improving housing, schools, water supplies, and hospital service are being done only on an "interim" basis. Theoretically, these services will be assumed by National Iranian Oil Co. and local governments. Actually, it is conceded that any such assumption of this social service is a long way in the future.

These very direct aids to raising the Iranian standard of living are tangible things that can be seen, but they are almost entirely in Khuzistan where the oil development is. They are a long way from Teheran and the remote vastness of Iran. All Iran will have to feel the benefit from its oil if Iranians are going to be satisfied.

WHY YOU CAN DEPEND ON THIS TOOL JOINT

In the "Oil Patch" proof is in performance! And in 35 years, Hughes tool joints have been used on more than 75 *million feet* of drill pipe . . . in fields around the world. Hughes pioneered the development of fully heat treated alloy tool joints. And Hughes engineers perfected the metallurgical processes that have given these tool joints their greater strength, toughness and resistance to wear and galling. That is the reason why HUGHES' field-proven tool joints are today's first choice for dependability.

HUGHES TOOL COMPANY
HOUSTON, TEXAS

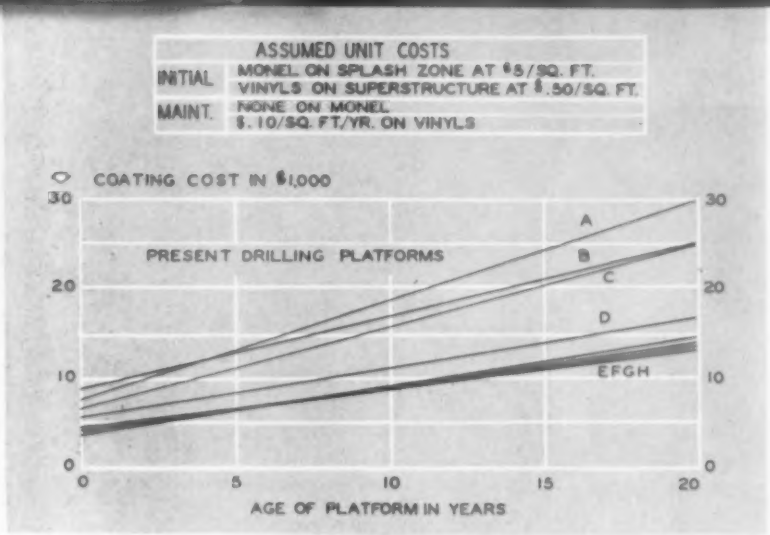


This delivery was planned long before you spudded in

Months before the location stake was driven, you were assured the delivery of the right HUGHES bits to your rig . . . *ahead of time.*

This was made possible by the 400-man HUGHES field service organization working closely with operators in every drilling area of the United States and Canada to determine future rock bit needs.

The combined estimates of HUGHES field servicemen and operators form the basis on which HUGHES' manufacturing schedules are set up. That is why HUGHES bits of the correct sizes and types move into strategically located warehouses well in advance of actual requirements. And it is the reason *you* can depend on your HUGHES field serviceman having the right bits at your rig . . . *ahead of time!*



LOWER MAINTENANCE COSTS go hand in hand with reduced areas. Curves are theoretical costs per well for protecting eight platforms against atmospheric corrosion. Fig. 1.

by Daniel B. Stauffer

TABLE 1

Square Feet of Steel Surface Exposed to Atmospheric Corrosion (on Per Well Basis)

(Eight drilling platform designs by seven offshore operators)

Design	Splash zone −2 to +6 M.G.L. (sq.ft.)	Superstructure above +6 M.G.L. (sq. ft.)
A	325	11,250
B	910	8,180
C	385	9,090
D	425	5,880
E	155	5,610
F	250	5,200
G	300	4,940
H	330	4,800

Reduced Upkeep Cost on Drilling Platforms

A MINIMUM OF AREA in the splash zone and lower superstructure makes this type platform easy to protect. Fig. 2.

Begins With Good Design

Designers of offshore platforms have a big responsibility in making it easier and cheaper to protect these platforms against corrosion. The main things a designer must do are (1) reduce total surface area, (2) eliminate hard-to-coat areas, and (3) protect the coating and structure against mechanical damage.

ADEQUATE corrosion protection of offshore structures is an absolute and expensive necessity. The present cost of initial and maintenance painting of platforms alone is conservatively estimated at $2,500,000 per year, industrywide.

How can we cut down on the cost of offshore corrosion control? One solution is for the structural design engineer and corrosion engineer to join forces on design. Proper platform design will reduce corrosion and make initial and maintenance protection easier, cheaper, and more effective.

What does this proper design involve? The following are major points in designing for minimum cost of offshore corrosion control:

1. **Reduce surface area** in all parts of the structure. Members should be moved from the splash zone and lower superstructure into the submerged zone and upper superstructure where protection is cheaper and easier. Area of deck sections should be reduced by good structural design, by boxing in structural members, and by removing unneeded steel after drilling is over.

2. **Eliminate hard-to-coat areas** where possible. Use tubular members instead of structural shapes; eliminate fabrication and water-phase erection joints. Box and seal structural members; use corrosion-resistant materials such as concrete, and finally, install permanent maintenance aids.

3. **Protect coatings and structures** from mechanical damage. Design good fender systems for landing, loading, and mooring equipment. Protect the coating against drilling-fluid damage.

Reduction of Surface Area

Reduction of surface area in any zone of an offshore platform cuts the cost of initial and maintenance protection. Three zones must be considered:

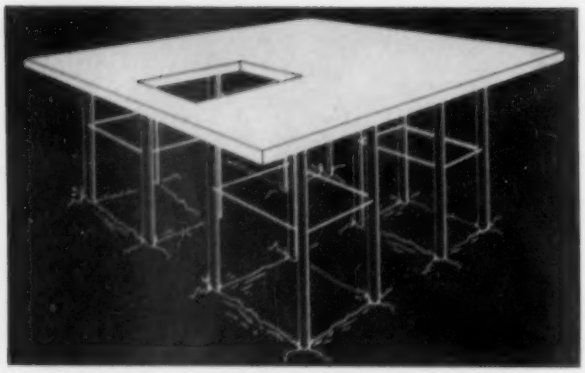
1. The splash zone, or area between −2 and +6 ft., Mean Gulf Level.

2. The superstructure, or area above +6 ft.

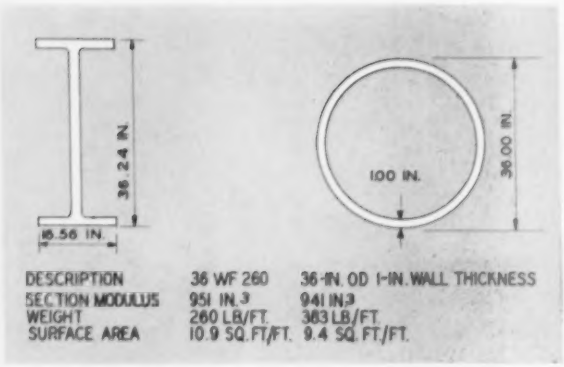
3. The submerged zone, or everything below −2 ft.

These zones present entirely different

Author is with Humble Oil & Refining Co., Houston. From paper presented at the South Central regional meeting of the National Association of Corrosion Engineers, Houston.



BOX-TYPE DECK is perhaps the most simple answer to getting rid of some hard-to-coat areas. Fig. 3.



TUBULAR MEMBERS can't replace structural shapes in all cases, e.g., where bending moments are large. Fig. 4.

corrosion problems but are interrelated structurally. For example, elimination of members in the splash zone may require adding members in the submerged zone.

Corrosion protection costs . . . Cathodic protection is cheap and effective in the submerged zone. Even overdesigned magnesium-anode systems cost less than 5 cents per square foot of bare steel per year.

For the splash zone most operators consider welded monel sheathing at about $5 per square foot as the best bet. But this zone is highly vulnerable to boat damage and maintenance here is the roughest problem we have to face.

Superstructure coating costs vary from 25 to 50 cents per square foot, depending on type of coating and surface preparation. Maintenance painting will cost 10 to 20 cents per square foot annually and will be cheaper 30 or 40 ft. above the waterline than in the lower superstructure.

Table 1 lists square footage of exposed surface on eight drilling platforms designed by seven operators. Total areas have been reduced to areas per well since platform capacities vary from 3 to 11 wells.

What do these figures mean cost-wise? Fig. 1 tells the story, based on assumed unit protection costs over 20 years. Design "E" will theoretically save $10,000 per well in 20 years of corrosion control.

Splash and submerged zones . . . Fig. 2 shows what has been done in design to put the steel where protection is relatively easy. Eight 30-in. piles support a four-well platform void of braces between −2 and +27 ft. M.G.L.

Strength requirements may call for increased template diameter when splash zone braces are eliminated but the resulting surface area may be less. A four-well platform with eight 33-in. unbraced template legs has a splash zone area per well of 138 sq. ft. A six-well platform with sixteen 16-in. template legs has a splash zone area per well of 155 sq. ft.

Deck section area . . . Strength required during drilling dictates that deck sections be of structural steel shapes. The resulting area is extensive and hard to keep coated. It would be much better, corrosionwise, if all these beams are sealed in a box as sketched in Fig. 3.

One current platform has a structural-steel deck 80 by 90 by 4 ft. The exposed surface area is 21,200 sq. ft. Boxing would cut this to less than 15,000 sq. ft. and save $15,000 in protection costs over 20 years.

Another way to reduce deck-section surface area is to remove unnecessary members after drilling is finished. An entire drilling deck might be lifted off

CONCRETE-PILE PLATFORMS have long-time advantage over steel because of corrosion resistance. Fig. 5.

BOAT DAMAGE to coating and to template is big factor in design. Fig. 6.

and replaced with a lighter deck designed only for production and workovers.

Hard-to-Coat Areas

Every area on a platform in the Gulf of Mexico is a hard-to-coat area. But there are a number of points that the designer should consider to make these areas somewhat easier to maintain and thereby reduce cost of corrosion control. The hardest-to-coat areas are corners, crevices, joints, rough welds, edges, and all of the splash zone. To combat these difficulties the designer has several tools to use; they are tubular members, seal or box welding, large construction barges, maintenance aids, and his own experience.

Tubular members . . . Tubular goods are the workhorse of the oil industry—let's use them where we can. They reduce surface area and eliminate sharp edges and corners where paint fails first. Fig. 4 shows why tubular members are sometimes not feasible. The 36-in. 260-lb. wide-flange beam is used to support the derrick on an actual drilling platform. A 36-in. tubular member with the same resistance to bending moment would require a 1-in. wall, use 47 per cent more steel, and take up twice as much space.

Fabrication and erection joints . . . Fabrication and erection joints are another bugaboo in structural design. Every joint is a potential point of coating failure. Welds should be ground smooth and spatter removed if paints are to succeed.

Elimination of bracing in the splash zone and lower superstructure is an excellent move because every brace we take out gets rid of two fabrication joints.

Erection joints are even more serious because they are made during the water phase of construction. Since they are made at sea they must be coated at sea where painting may not be as effective.

Seal welds and boxing . . . The principles of seal welding and boxing in structural units have been well covered by Henry T. Rudolf in his paper, "Design Against Atmospheric Corrosion," in the August issue of Corrosion magazine. These principles are doubly important in the gulf where salt air and high humidity will penetrate any crack or crevice not sealed off.

Corrosion-resistant materials . . . Need for painting can sometimes be eliminated by use of corrosion-resistant materials. The most obvious choice for this is concrete. Reinforced-concrete production platforms of precast, prestressed members have been used in the gulf. Fig. 5 shows a 12-pile concrete platform being built. The steel braces just above the waterline are gunited.

SOME PROTECTION against boat damage is given by these timber mats, made from 2 by 4's, and strapped around gunited members. Fig. 7.

Drilling platforms have not been built of concrete because every well is not a producer and steel platforms are more easily salvaged. Concrete platforms are more expensive than steel and depend on long-term corrosion advantages to close the cost gap.

Welded monel sheathing is being used to limit corrosion and eliminate painting in the splash zone. But it has the disadvantage of being easily damaged by boats. Four out of seven companies questioned are using it on all steel structures.

Maintenance aids . . . One company has installed permanent paint scaffolds to make painting easier on deck beams and other difficult spots. An objection to this is that the scaffolds must be maintained. But almost every operator favors use of permanent hooks, eyes, brackets, etc., to make scaffolding easier when painting is done.

Protection Against Mechanical Damage

The designer isn't through when he has reduced the exposed surface to a minimum and eliminated hard-to-coat areas. Coating and structure must be protected against mechanical damage.

The first line of defense should be against boats and barges. Most boat damage is usually in the splash zone but high seas can spread damage to the lower superstructure. The battering of boats causes both coating and structural damage.

Fig. 6 is a beautiful example of such damage. The coal-tar coating applied 20 months before is hanging in shreds and the template leg is beaten in.

The best defense is to keep the boats away with bumpers, fenders, dolphins, or rubbing strips. The usual deep-water fender is attached to the structure itself. One type, using rubber bumpers fastened to a timber mat, is shown in Fig. 2. Fig. 7 shows 2 by 4-in. timbers banded over a gunite protective coating. Fenders integral with the platform have the disadvantage of increasing the total storm load by increasing the area affected by wave forces.

Fenders, bumpers, rubbing strips, etc., are themselves subject to damage. They are expendable and must be designed for easy replacement. Of the many designs used so far, none have been entirely satisfactory. Much design work needs to be done along the line.

Other factors . . . In planning offshore landing, loading, and mooring facilities the design engineer should always think of corrosion. The easier it is to land a man, the fewer passes the boat will have to make, and the fewer bumps the platform will have to take. Whirley cranes and stiff legs should be designed and placed so that heavy loads of pipe will never scrape the structure.

Another consideration is protecting the coating against damage from alkaline drilling fluids. Two operators are experimenting with solid decks, splash plates, and drains to save coatings from mud damage. Others are using mud-resistant coatings.

When your market fluctuates sharply . . .

Design for Flexibility

Phillips' Dumas, Tex., dry-gas processing plant operates at from 90 to 200 M.M.c.f.d.

by A. M. L. Kube and R. H. Stone
Phillips Petroleum Co.

PHILLIPS PETROLEUM CO.'s Dumas gasoline plant is now being expanded to circulate 1,750,000 gal. per day of absorption oil for increased gasoline extraction from the gas volumes of up to 210 M.M.c.f.d which the plant must process.

Located 4 miles southwest of Dumas, Tex., the plant was built in 1948. It was originally designed to process 85 M.M.c.f.d. of dry gas gathered from the vast Panhandle field of Texas with a liquid production of about 85,000 gal. per day.

This plant is designed to take the seasonal fluctuation of gas demand. The average daily gas volume to the plant currently is 150 M.M.c.f.d. It operates fully loaded at 210 M.M.c.f.d during the winter months and processes a volume of only 90 M.M.c.f.d. during summer months. This wide fluctuation demands considerable flexibility in plant operating ability to maintain optimum efficiency.

During its first years of operation, the plant operated at field line pressure of about 275 psig. However, the decline in reservoir pressure has lowered the operating pressure to 200 psig. which is now being maintained by gas compressors.

Process Flow

All the gas is processed in six 6-ft.-by-20-tray, 200-psig. (operating pressure) absorbers. While the plant was originally designed for an oil circulation of 1,200,000 gal. per day, it is currently being expanded to 1,750,000 gal. per day for greater liquid recovery. Kerosine manufactured in Phillips' Borger refinery, with approximately 175 molecular weight, is used for absorption media.

Rich oil from the absorbers flows through cold and hot banks of heat exchangers and necessary vent tanks to a direct-fired rich-oil preheater where the temperature is raised to approximately 400° F. for feed to the still. The oil is stripped of its gasoline in a 50-psig. (operating pressure) still with exhaust steam from turbines which drive lean oil pumps. The steam and oil is condensed from the gasoline vapors in a dephlegmator refluxed with water.

Denuded oil from the still kettle flows countercurrent to the rich oil through the shell side of heat exchanger. It is finally cooled in atmospheric coils in a natural-draft cooling tower from where it is returned to the absorbers. Heavy gasoline vapors from the still are condensed in the 50-psig. make-tank while the lighter vapors are compressed to 200 psig. for additional condensation.

Vapors from this high-stage accumulator are recycled to the main absorbers. The gasoline is fed to a product deethanizer where it is relieved of its ethane and light components. Propane-and-heavier components are transported to the Borger fractionator *(The Oil and Gas Journal, April 27, 1953)* for further fractionation into various components for blending or direct sale. Centrifugal process pumps, driven by either steam turbines or electric motors, are usually used in the plant.

Field gas to the plant contains about 86 grains H_2S per 100 cu. ft. In order to prepare this gas for sale, the H_2S content is reduced to less than 0.25 grains H_2S per 100 cu. ft. in a treater upstream of the oil absorbers. The treater operates at 200 psig. and uses an amine solution for the sweetening process.

All the gasoline-plant process and gas cooling, except the dephlegmator reflux which is cooled by air-fin units, is done in three natural-draft cooling towers, totaling 49 bays.

Compressor System

Gas compressors have been added as required to maintain plant pressure at 200 psig. As a result, five 1,320-hp. compressors and one 2,200-hp. compressor are now operating to make the gas delivery. Water for these engines is circulated in a closed system and is cooled to 135° F. in air-fin coolers.

MAJOR PROCESS EQUIPMENT at the Dumas plant. In foreground are desulfurizers and stills. In background are deethanizer and absorbers. Photograph by Harold Jackson.

Water to the power cylinders is controlled to allow a maximum of 10° F. temperature rise through the jackets.

Starting air is provided by soap-lubricated compressors which compress the air to 200 psig. This type compressor is used to preclude the possibility of air-line explosions which might result from air compressors lubricated by oil. This is considered a significant safety feature in the design of compressor stations.

All the compressors are protected by high-level shutdown switches on the inlet scrubbers to prevent liquid entering the compressors.

Inlet gas scrupbber . . . During winter months, considerable hydrocarbon condensation takes place in the gathering system and some slugging of liquids into plant scrubbers has caused upsets in plant operations. To protect plant equipment against these large slugs of liquids, a 10 by 40-ft. tank has been installed on the plant inlet to collect the large volumes of liquid which may suddenly appear in the plant inlet-gas lines.

Fire Fighting and Fire Prevention

The plant incorporates all the necessary precautions against the the possibility of fire or explosions. Explosion-proof motors are used throughout and all possible sources of gas ignition are located a safe distance from the area where explosive mixtures might normally occur. A manual electric-shutdown system is provided so operators can, from a remote position, shut down gas-compressor engines, generators, boilers, and direct-fired preheaters if inflammable vapors are accidentally released.

DUMAS PLANT STREAM ANALYSES

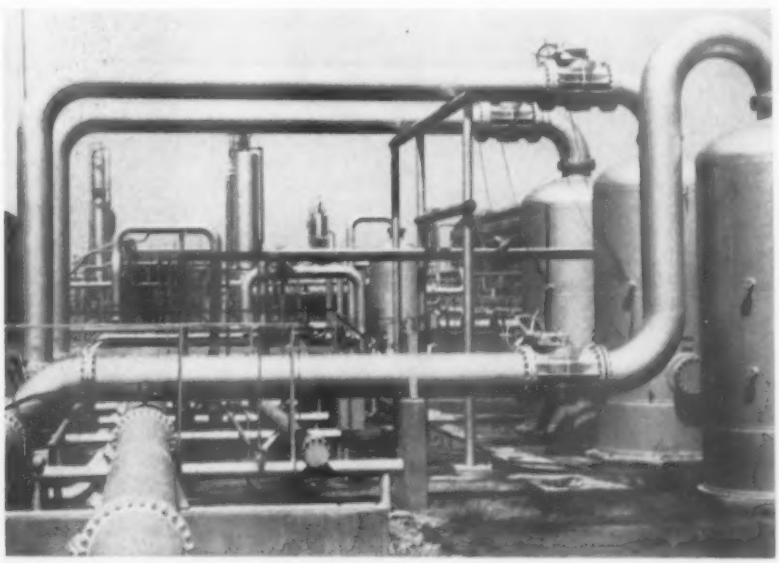
	Mole per cent			
	Inlet gas	Residue gas	Deethanizer feed	Plant product
N_2	11.34	11.57		
C_1	75.56	78.01	3.48	
C_2	6.44	6.58	8.69	
C_3	4.05	3.29	26.56	27.83
C_4	1.75	0.51	37.67	44.39
C_5	0.55	0.04	15.28	18.51
C_6+	0.31		8.32	9.27
Total	100.00	100.00	100.00	100.00

Three fire pumps having a total capacity of 1,100 gal. of water per minute are located a safe distance apart so if either of the pumps happens to be in the fire area, the other may be used. For further protection, one of the pumps is driven by a steam turbine, one by an electric motor, and the other by a gasoline engine. This assures that one of the pumps will be ready for operation at all times.

These pumps take suction from a 10,000-bbl. raw-water tank in the plant yard. Many other fire extinguishers are also available to fight all types of fires which might occur in a gasoline plant.

To increase the utility of the very latest in fire-fighting equipment, regular fire-fighting drills and first-aid courses are held for plant operators. These are held in connection with the regular monthly safety meetings in which oil, gasoline, and gas-pressure fires are actually put out and controlled.

Special instruments . . . For ease of operation and to provide a quick method of checking various critical plant temperatures, a potentiometer has been provided to cover virtually all vital temperature points in the plant. The receiving instrument is centrally located in the control room for easy access by operators on duty. Engineers and plant supervisory personnel also find this instrument very useful in making routine checks on plant operation.



GAS SCRUBBERS and piping adjacent to compressor station. Gasoline plant is in background.

Plant utilities . . . Most of the electric power required in the plant is furnished by three 312-kva., 480-volt generators driven by gas engines. Supplemental power is purchased from the local power company.

Steam for processing is produced by three 280-hp. water-tube boilers operating at 260 psig. The raw-water make-up above the condensate which is returned from the plant is treated to zero hardness by a 7,000-gal.-per-hour-capacity hot lime-soda, hot-phosphate process treater.

Water is supplied from two water wells located near the plant. These wells adequately furnish the 7,000 bbl. per day of fresh water required for plant operation and camp use. A 10,000-bbl. raw-water storage tank is provided for normal plant surge and to provide volume for fire-pump use.

Operating personnel . . . A total of 26 men are employed in the operation of the plant. Each operating shift consists of four men, two on the processing equipment and two on the compressor system. Routine maintenance, including a program of preventive maintenance on the large engines, is performed by the plant personnel. In charge of the plant is D. E. Logan, superintendent. Plant supervisors are H. E. Sullenger, process supervisor, and R. W. Lane, engine foreman.

This plant was designed and constructed by Phillips' gasoline department.

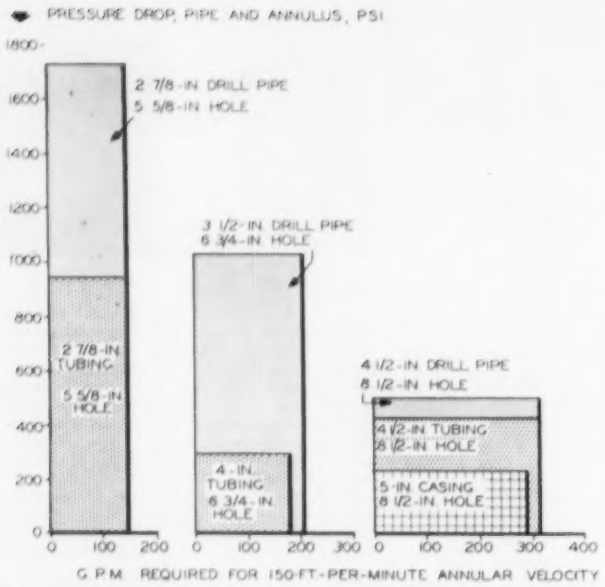
THE AUTHORS

A. M. L. KUBE

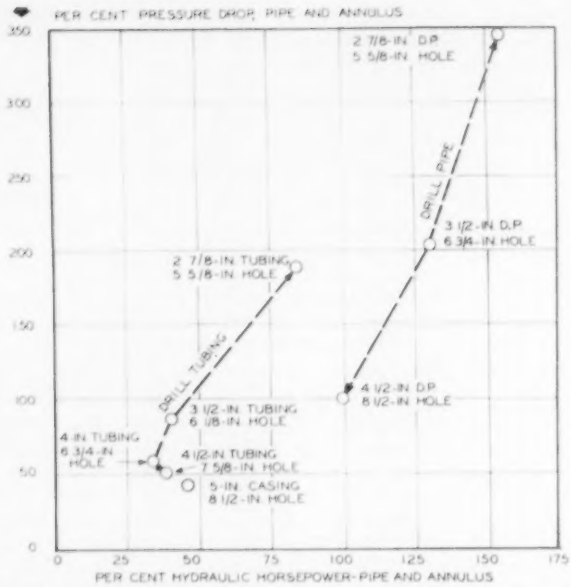
R. H. STONE

A. M. L. Kube is gasoline-plant process-engineering supervisor for the gasoline department of Phillips Petroleum Co., Bartlesville, Okla. He graduated from Texas Technological College in 1942 with a B.S. degree in industrial engineering. Immediately upon graduation he was employed by Phillips in the gasoline department at Phillips, Tex. After 6 years in the Panhandle district he was transferred to Bartlesville.

R. H. Stone is gasoline-plant process-engineering supervisor in Phillips' Panhandle district. He was graduated from University of Tulsa in 1940, with a B.S. degree in refinery engineering.



REQUIRED MUD FLOW RATE and resultant pressure drop to obtain the prescribed annular velocity for different drilling strings in the same size holes. Fig. 1.



PERCENTAGE COMPARISON, pressure versus horsepower, for various drill strings and hole sizes. All points for same depth hole. Fig. 2.

Deeper Drilling With Less Horsepower

by R. E. Westling
Gulf Oil Corp.

LOWER capital investment, lower operating costs and lower moving costs are possible through the use of drill tubing or casing in place of drill pipe. In addition, present rigs now using drill pipe can drill deeper by using drill tubing and can do the job at less expense.

The accompanying data and charts show, along with other comparisons, relative horsepower requirements for drilling with various sizes of drill tubing, drill casing, and drill pipe. The data sheet has been prepared with specific conditions for each drill string. They are:

1. A standard size of hole that can be drilled with each size drill string through a standard casing in which the drill string can be washed over and fished and in which standard casing can be set.

2. An annular fluid velocity of 150 ft. per minute.

3. A hole depth of 10,000 ft.

A similar comparison of pump horsepower requirements will exist for any length of drill string. The pump horsepower requirements of the surface connections, drill collars, and bits will be in addition to that required by the drill string. These factors become a smaller part of the over-all pump horsepower requirements as the length of the drill string increases.

All hydraulic figures are for comparative purposes only and are so calculated; they do, however, parallel various available theoretical and field data. All percentages are relative to the 4½-in. drill-pipe column requirements merely because most drilling is with that size pipe and, therefore, its requirements are more generally known. All sizes of hole and casing are for general drilling conditions, but could be made proportional to special conditions.

Drill tubing economies . . . Fig. 1 shows the required mud flow rate and resultant pressure drop to obtain the prescribed annular velocity for different drill strings in the same size holes. The area of each block is directly proportional to hydraulic horsepower. The 2⅞-in. drill tubing can be used to drill the same size hole as 2⅞-in. drill pipe with about half the horsepower. Neither string would be advisable for deep drilling because the pump horsepower is out of balance with hoisting horsepower. Furthermore, standard pumps are not available or economical for this small capacity and high pressure.

The 3½-in. drill tubing seems to be the ideal size for slim-hole type drilling of reasonable depth. The pump pressure required is also more in line with available pumps. The hoisting horsepower requirements are not plotted but the load factors for related casing and drill strings are shown on the data sheet. A rig to drill to 10,000 ft. or reasonable depth using the 3½-in. drill tubing would cost less to buy and cost less to operate than a rig using 3½-in. drill pipe or 2⅞-in. drill pipe. In addition the 3½-in. drill tubing could drill through 7-in. casing whereas the 3½-in. drill pipe would require 7⅝-in. casing so that a large enough hole could be drilled to allow fishing of the drill pipe. Five-inch casing could be set in either hole.

Depth of Hole

This brings up another point that should be considered in slim-hole-type drilling and that is the depth of the hole for the 7 and 7⅝-in. casing. The 3½-in. drill pipe would normally drill a 9⅞-in. hole for the 7⅝-in. casing. The 3½-in. tubing would require only an 8½ to 8¾-in. hole for the 7-in. casing. Therefore, the 3½-in. drill tubing could drill a much deeper surface casing hole, with the same pump horsepower, than could be drilled using 3½-in. drill pipe.

COMPARISON OF EQUIPMENT AND OPERATING REQUIREMENTS FOR DRILL TUBING AND DRILL PIPE
(4½-in. drill pipe string used as the basis of all relative values)

Drill string—	2⅞-in. tubing with couplings	3½-in. tubing with couplings	4-in. tubing with couplings	4½-in. tubing with couplings	2⅞-in. pipe with tool joints	3½-in. pipe with tool joints	4½-in. pipe with tool joints	5-in. casing with couplings
Drill string o.d., in.	2⅞ E.U.E.	3½ E.U.E.	4 E.U.E.	4½ E.U.E.	2⅞ I.F.	3½ I.F.	4½ I.F.	5
Drill string normal size, in.	2½	3	3½	4	2⅞	3½	4½	5
Drill string, lb. per ft. and grade	6.50, N-80	9.30, N-80	11.00, N-80	12.75, N-80	10.40, E	13.30, E	16.60, E	15.00, N-80
Drill string i.d., in.	2.441	2.992	3.476	3.958	2.151	2.76	3.826	4.408
Coupling or T.J. o.d., in.	3.668	4.50	5.00	5.563	4.125	4.75	6.125	5.360
Collapse pressure, psi.	8,900	8,580	7,520	6,680	13,210	11,290	8,310	6,520
Collapse depth rating, ft.	15,820	15,250	13,370	11,880	23,480	20,070	14,770	11,590
Tensile strength, psi.	144,960	207,220	246,140	288,040	214,000	272,000	331,000	402,000
Tensile depth rating, ft.	22,300	22,280	22,380	22,590	20,610	20,420	19,910	16,770
Volumetric capacity, bbl. per 100 ft.	0.58	0.87	1.17	1.52	0.45	0.74	1.42	1.89
Overshot o.d., in.	4⅝	6	6¼	7½	5	6⅛	8⅛	8⅛
Washover pipe o.d., in.	4½	5½	6	7	5	6	7	7
Washover pipe i.d., in.	3.875	5.012	5.524	6.456	4.408	5.524	6.456	6.456
Washover shoe for above o.d., in.	4⅝	6	6½	7⅜	5½	6½	8	8
Bit size (min.), in.	5⅝	6⅛	6¾	7⅝	5⅝	6¾	8½	8½
Casing to drill through (min.), o.d., in.; lb. per ft.	6⅝, 24	7, 26	7⅝, 26.40	8⅝, 36	6⅝, 24	7⅝, 26.40	9⅝, 40	9⅝, 40
Production casing (max.), o.d., in.	5	5	5	5½	5	5	7	7
Weight—10,000-ft. production casing, lb.	150,000	150,000	150,000	170,000	150,000	150,000	290,000	290,000
Weight—10,000-ft. drill string, lb.	65,000	93,000	110,000	127,500	104,000	133,000	166,000	150,000
Hoist requirement (per cent of 4½-in. D.P., wt.)	39	55	66	76.5	63	80	100	90.4
Hoist requirement (per cent of largest prod. casing, wt.)	52	52	52	59	52	52	100	100
Volumetric capacity (per cent of 4½-in. D.P.)	41	61	82	107	32	52	100	133
Annular capacity, bbl. per 100 ft.	2.28	2.50	2.87	3.68	2.28	3.24	5.05	4.59
Annular capacity (per cent of 4½-in. D.P. column)	45	49.5	55	73	45	64	100	91
Flow rate (ann. vel., 150 ft. per min.), bbl. per minute	3.42	3.75	4.30	5.52	3.42	4.86	7.55	6.89
Velocity inside drill string, ft. per minute	590	430	366	363	760	653	532	364
Relative pressure drop in pipe, per cent*	191	81	52	45	360	210	100	40.8
Relative pressure drop in annulus, per cent	146.1	152.0	145.7	128.0	146.1	123.2	100	114.1
Relative pressure drop in total, per cent	188.0	86.0	58.8	50.8	345.0	204.3	100	45.9
Relative horsepower in annulus, per cent†	65.7	73.8	82.9	93.3	65.7	79.0	100.0	103.8
Relative horsepower in pipe, per cent	86.0	39.4	29.7	32.7	162.0	134.6	100.0	37.13
Relative horsepower in total, per cent	84.6	41.8	33.5	37.0	155.3	131.0	100.0	41.8

*$\Delta P = C_1$ [(vel.)^2 (i.d.)]. †hp. $= C_2$ (ΔP) (bbl. per min.).

How about strength? . . . The advantages of the 4-in. drill tubing over 3½-in. drill pipe, for the same size hole, are obvious in both Figs. 1 and 2. The 4-in. drill tubing is lighter in weight than the 3½-in. drill pipe but would require about the same size draw works and hoisting horsepower as far as rig design is concerned. The pump horsepower required for the 3½-in. drill pipe, however, is almost four times the horsepower required for 4-in. drill tubing, and the pump pressure required is about three times greater with the 3½-in. drill pipe as compared with the 4-in. drill tubing.

The collapse limit is less for the 4-in. drill tubing than for the 3½-in. drill pipe, but it is almost as great as for 4½-in. drill pipe which is in common usage. The tensile load rating for the 3½-in. drill pipe is greater than the 4-in. drill tubing but the allowable pull at the bottom of a 10,000-ft. string of 4-in. drill tubing is practically the same—139,000 lb. for the 3½-in. drill pipe and 136,140 lb. for the 4-in. drill tubing. The torque characteristic of drill tubing is better than for the drill pipe for the same weight of steel because of the effect of a greater radius of steel.

Power for deep holes . . . In larger size holes the 4½-in. drill tubing has similar advantages over the 4½-in. drill pipe. A smaller rig with less horsepower on the hoist and on the pumps will do the job at less cost. This also can be restated in that present equipment now using drill pipe could drill deeper by using tubing, and jet bits could be used effectively to a greater depth. The 5-in. drill casing has an even greater hydraulic advantage over the 4½-in. drill pipe in the same size hole as shown in both figures.

It should be noted that the figures for 4½-in. tubing and 7⅝-in. hole are used on the data sheet and the percentages for this combination are plotted in Fig. 2. On the block chart of Fig. 1, however, calculated data for 4½-in. tubing and 8½-in. hole have been used to show the comparison of 4½-in. drill pipe, 4½-in. drill tubing, and 5-in. drill casing in the same size hole.

Choice of couplings . . . The mechanics of using drill tubing has been greatly improved and experience indicates that it can be a practical means of reducing drilling costs. Various couplings for drill tubing have been developed and additional ones are being developed. The couplings referred to herein are those with an outside diameter the same as standard tubing collars with flush inside diameter. The couplings for the drill casing can have an outside diameter up to the same size as the 4½-in. drill pipe or they can be 4½-in. drill-pipe tool joints. Drill-tubing strings with oversize couplings or internal upset couplings could also be tabulated.

The factors of less capital investment for drilling equipment, less cost of operations, and less cost for moving are important in domestic operations. These costs become even more important in foreign operations especially foreign exploratory operations where depreciation, transportation, and fuel costs are major cost items. The hydraulic horsepower advantages of drill tubing and drill casing over drill pipe are sufficient to make it possible to drill deeper with less horsepower and at less cost.

THE AUTHOR

R. E. Westling is division engineer, foreign production division, Gulf Oil Corp. He joined Gulf after graduating from Colorado School of Mines in 1937 with a degree in petroleum engineering. In 1940, Westling entered the Corps of Engineers. While in the Corps he was in charge of Operation Canol project at Norman Wells, Canada, and later became chief of the development and rehabilitation section and chief of the planning fuels and lubricants division in Washington. In 1945 he rejoined Gulf in the foreign production division.

Here are a few selected examples of

New Petrochemical Instrument Applications

by R. G. Marvin, W. L. Stuart, G. W. Lunsford, and E. E. Ludwig

THE petrochemical industry has an active interest in new instruments and in their development for process applications. Along with the growth of the chemical, petroleum, and petrochemical industries there has been a large increase in the types of problems for which the user companies have actually attempted to carry on the necessary research of instrument development. This involves development as to both application and manufacture. The extent of instrument research usually depends upon the size of the user company and the relative importance of instrumentation in its total economy. Much of this development has included corrosion testing, and the effects of corrosion on the special features of instruments.

In general, we believe it is correct to state that most of the large and many small petroleum, chemical, and petrochemical companies carry on a definite program regarding instrument applications and mechanical development. It is not difficult to point out instances where these companies have actually contributed considerable knowledge to the field of instrumentation. Also, it is most evident that the demand for some types of instruments has forced instrument companies to push their own development programs. Often this "push" has been in a direction that they normally might not have pursued. However, with the demand justifying the need, much has been accomplished.

Instrumentation in these user plants is also progressing each day by proving the effective application of standard units and parts in special situations.

Although we are limiting this discussion to petrochemical plants, it is undoubtedly quite applicable to a large number of petroleum and chemical plants as will be evident in some of the comments to follow.

Items dealt with here are: (1) automatic computers, (2) relative flow measurement of gases at high pressure, (3) ratio flow control for gas-phase reactions, (4) use of strain cell for pressure control, (5) control of ammonia refrigeration system, (6) sealed meter for corrosive liquid, and (7) flow measurement by impeller-type flow-sensing cell.

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1. Automatic Computers

Automatic computers in industry are relatively new and probably confined to the last 8 to 10 years as far as widespread industrial applications are concerned. The use of this equipment by government agencies or government-sponsored agencies preceded this period and still carries on. Most of the large machines were applied entirely to the government scientific and defense applications. Industry as a whole has awakened to the possibilities of automatic computation and data processing and has begun to participate strongly in the application of this equipment. In a broad sense, automatic computers are the result of the application of instruments and instrument parts to operate as a unit.

Automatic computers are generally classified as mechanical, electrical, and electronic. The electronic is the latest development, but it has not completely replaced the electrical computer; and there are some larger and older electromechanical units still in operation. The applications for this equipment fall generally into the classifications of (1) office procedures, which includes filing, sorting, processing of records, data, etc., and (2) scientific, which includes computations and system analysis by simulation.

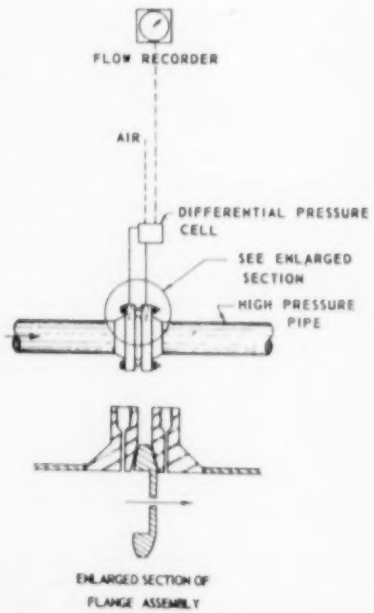


Fig. 1—High-pressure flow measurement.

Digital and analog . . . Automatic computers are rather naturally divided into digital and analog types. Each of these has its own respective area of application with only a reasonably small degree of overlap in capabilities between them. The analog machine is more adaptable to simulation of difficult or indeterminate systems and to the solving of problems of varying differential equations. Its economical precision is limited to between 1 and 0.1 per cent. The digital machine solves complex problems of all sorts including differential equations; however, its adaptation to system simulation is not as good as the analog machine. The precision for a medium-size machine will run between 0.001 and 0.00001 of 1 per cent.

Computer applications . . . Automatic computers have definitely been established in the petrochemical industry and here again it is this widespread acceptance that has caused many manufacturers to put additional emphasis on developing their computer equipment. This competitive element has proved to be helpful. Better equipment is being made available quicker, and staffs are being trained by the equipment manufacturers and the colleges also, in order to utilize the capacities of these mechanical and electronic "brains."

Following are a few selected computational problems that have been solved economically on automatic computing equipment:

Analog

1. System simulation
2. Differential equations
3. Arithmetic operations
4. Heat transfer
5. Acoustics
6. Fluid flow

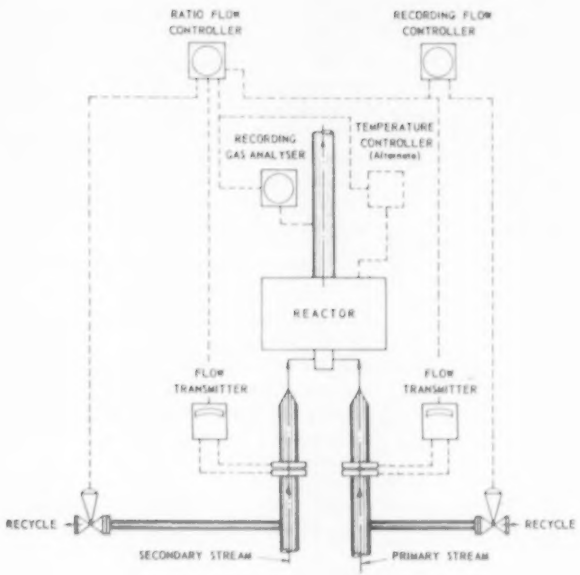


Fig. 2—Ratio flow control.

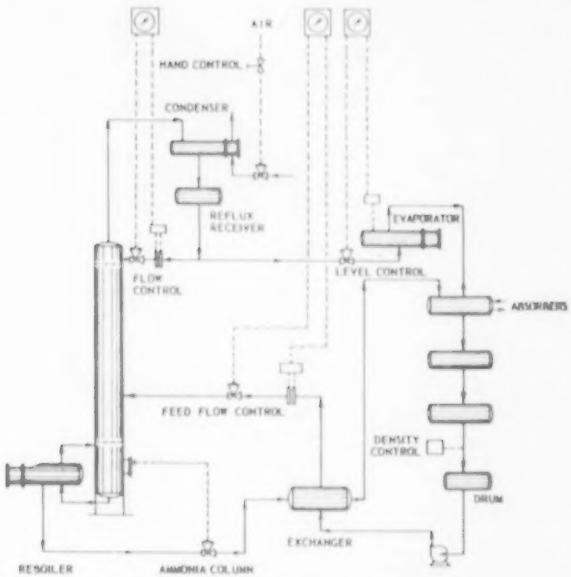


Fig. 4—Absorption refrigeration system.

Digital

1. Distillation
2. Horizontal tank-gage tables
3. Traffic—economic shipping points
4. Refinery economical balances
5. Fluid flow
6. Process reaction kinetics
7. Differential equations
8. Arithmetic operations

2. Relative Flow Measurement at High Pressure

The measurement of the flow of gases at high pressure has been a rather difficult service for instruments of today. Some work has been done and is continuing to be done to improve the accuracy of absolute measurements of gas flow in the region of 3,000 to 50,000 psi. A problem of gas-flow measurements in the region of 3,000 to 9,000 psi, proved to be quite challenging. Since the major instrument manufacturers and various other companies specializing in difficult applications could not offer flow meters or other equipment to handle this problem, the petrochemical company undertook to solve it.

It was immediately evident that the complete development of an accurate instrument would require more money, time, and facilities than were available. It was necessary to settle for a relative flow-quantity measurement, since a control point could be established on the relative changes in flow as long as the approximate accuracy of the operation was known. This accuracy could be obtained by calculation from the speed and capacity of reciprocating compressors.

Orifice-flange installation . . . With the assistance of a flange manufacturer's technical service group it was decided to drill and tap the existing flanges in the high-pressure piping system where flow measurement was required. Calculations indicated that drilling ⅛ or ¼-in.-diameter holes radially through the flange would not affect the safety of the flanges. The taps in the flanges were not exactly in the positions required according to the best practice; however, they were placed in the only locations possible. By checking after installation, the accuracy was established to be plus or minus 7 per cent.

The lens-type gasket was being used in the process piping, and a blind gasget was used to fabricate the orifice for the flow measurement. This was installed in the line between the flanges with no change in the piping-system dimensions. Fig. 1 shows schematic arrangement and section of orifice-flange installation.

Flows compared . . . In this installation one flow is compared with another flow which is parallel and which fluctuates in a somewhat similar manner. Controls can be established from any selected point and should then give relative readings. The pressure differential of the flange taps is picked up by a special high-pressure differential-pressure transmitter. The readings are then pneumatically recorded in the control room. The controls are not operated as automatic controls, but rather as reference points on the flow charts of these orifices. Control-valve adjustment to keep the systems balanced is made by pneumatic remote hand-valve operation.

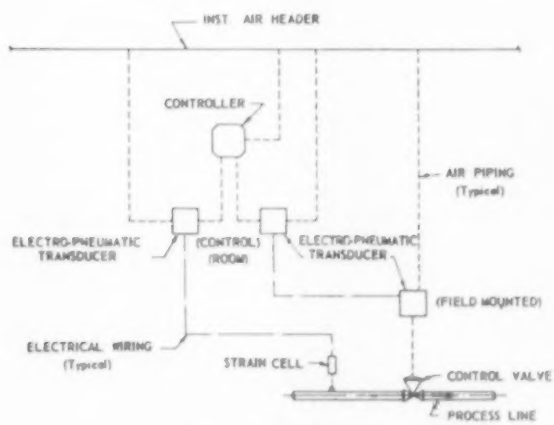


Fig. 3—Pressure control.

3. Ratio Flow Control of Two Gas Streams in a Process

There are some petrochemical processes that use gas-phase reaction. To make the operation efficient and successful, close control of the raw material is necessary. The exact quantities of gaseous material must be fed to keep the system chemically balanced. Failure to meet this requirement could result in loss of production yield, and

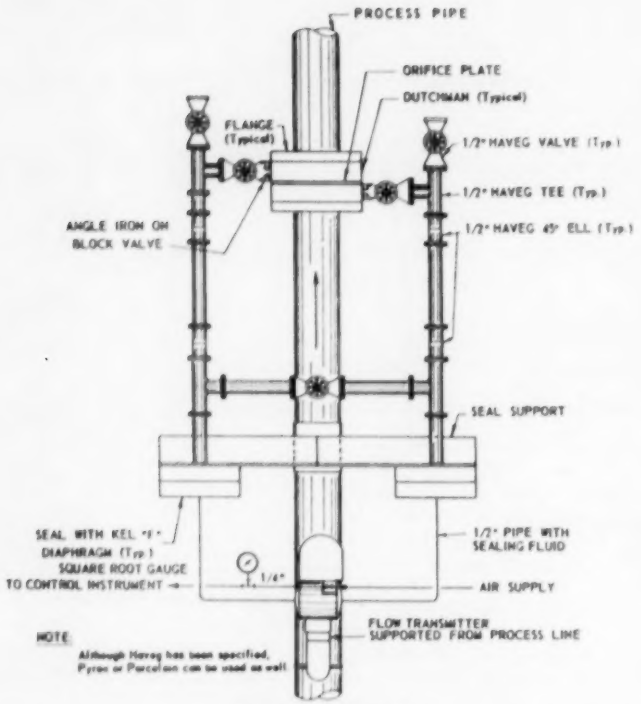

PROCESS PIPE
ORIFICE PLATE
DUTCHMAN (Typical)
FLANGE (Typical)
1/2" HAVEG VALVE (Typ.)
1/2" HAVEG TEE (Typ.)
ANGLE IRON ON BLOCK VALVE
1/2" HAVEG 45° ELL (Typ.)
SEAL SUPPORT
SEAL WITH KEL "F" DIAPHRAGM (Typ.)
SQUARE ROOT GAUGE TO CONTROL INSTRUMENT
1/2" PIPE WITH SEALING FLUID
1/4"
AIR SUPPLY
FLOW TRANSMITTER SUPPORTED FROM PROCESS LINE
NOTE
Although Haveg has been specified, Pyrex or Porcelain can be used as well

Fig. 5—Sealed meter.

waste of power and other service in handling the process constituents.

Control for gas-phase reactions . . . This can be solved by the use of standard flow instruments properly integrated to give the required material quantities. A flow transmitter sending an output signal to a ratio flow controller establishes a fixed point for the primary stream which balances against the secondary stream flow. A monitor control, such as temperature point or gas analysis, provides a means for maintaining the proper portions of feed components for maximum reaction efficiency. The output from the monitor positions the balance point between the flow transmitter outputs and results in a flow change of the secondary streams to keep the process balance. The schematic arrangement is shown in Fig. 2.

A variation of this system would be to have the monitor control recorded on a standard recording instrument with a manual set of the secondary flow-control instrument.

Safety features can be incorporated into such a control system to shut down the process in case of interruption of either the primary or secondary flow system.

This automatic control of gas phase-reaction processes has been used very successfully in petrochemical plants. The incorporation of safety shutdown features has proved to be a very valuable part of the installation for protection of personnel and equipment.

4. Use of Strain Cell for Pressure Control

The problem of controlling piping-system pressures above those of normal operations with fast speed of response was solved by the use of a strain cell. The process encountered was such that normal lags in transmission from the primary element and final control loop could not be tolerated. It was also desirable that the primary element detect minute pressure changes. The controller was required to position a pneumatically operated control valve, set another controller, and to supply alarm and interlock device contacts. (Fig. 3).

To fulfill this requirement, a resistance-strain pressure cell was chosen as the primary device. The receiving instrument was one of the electronic type calibrated with a suppressed reading; that is, full scale is used for recording only a portion of the resistance change of the strain cell. By this method, maximum sensitivity is obtained. The receiving output of the instrument is a pneumatic signal, which is converted to an electrical signal. This in turn is reverted to a pneumatic signal near the pneumatically operated control valve. By using this system, long pneumatic control lines are replaced with one pair of electrical conductors, and it is necessary only to supply electrical power at the pneumatic to electric signal changer.

The foregoing method of converting from a pneumatic signal to an electrical value for transmission, then back to pneumatic, was handled by the use of an electronic pressure transmitter and servoelectrical - pneumatic transducer. The additional costs for such a unit would seem rather high for ordinary types of control; however, as was pointed out, the speed of response required for this control plus the reduced costs of the installation justified it.

5. Control of an Absorption Refrigeration System

Absorption systems utilizing ammonia have been in industrial refrigeration service for many years. In general, they are an economical source of moderately low-level refrigeration when the tonnage capacity exceeds 200-300 tons per day.

Experience with the control of these systems indicates that the application of good instrumentation principles will give a satisfactory system. There are some features that can be subjected to study and thereby produce a cycle which is almost trouble-free. Some of the features of such a cycle are to be briefly discussed. By reference to Fig. 4, the suggested key points of control have been indicated, with supplemental control to be added at the preference of the operator.

Starting at the distillation column which strips water from an aqua solution, producing refrigeration-grade ammonia overhead, there is installed a flow control for reflux in contrast to some recommendations of differential temperature control. Experience has shown that the theoretically possible is not practical. This is primarily due to an insufficient concentration change and corresponding negligible temperature differences, and the unpredictable effects of subcooling. Differential temperature would undoubtedly work satisfactorily for systems subject to wider fluctuations in overhead purity. To use a flow control in such a system requires the elevation of the overhead condenser sufficiently high to allow a small working head for the control valve. This head can be 10 to 15 ft. with care in selection of the valve.

Flow control of the feed and level control of the forwarding bottoms has proved quite satisfactory. This is in contrast to recommendations which would operate the feed by level control and flow control the forwarding bottoms.

Remote pneumatic hand flow control of the cooling water to the overhead condensers of the column allows the control operator to maintain a uniform temperature and corresponding pressure on the system without some of the disadvantages which have been observed for automatic controls maintaining constant temperature of outlet liquid.

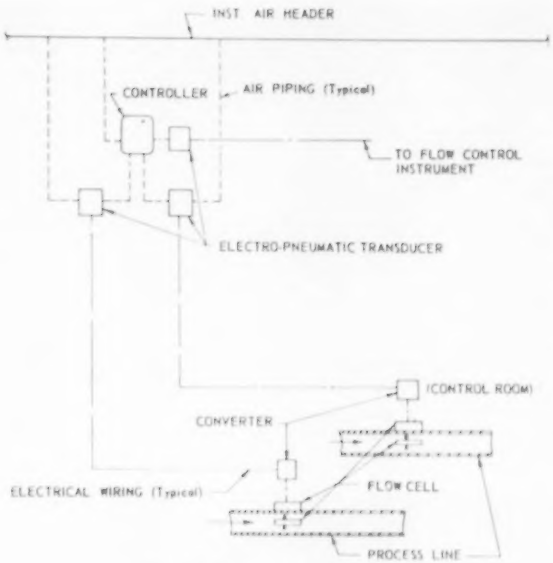


Fig. 6—High-pressure flow cell.

The control of the density of the strong aqua produced in the absorbers has proved to be quite satisfactory. The only other real control point is the liquid anhydrous ammonia as it is pressure regulated or level regulated into the evaporator utilizing the refrigeration of the system.

The balance of the system will naturally contain temperature, pressure, flow and perhaps level indication points for aiding the operator, but these are not the principal points which determine the operating balance of the system.

6. The Sealed Meter

Metering a highly corrosive liquid flowing at a high rate has been solved by the use of a sealed differential-type meter. Normally, corrosive flow measurement is handled in one of two ways—either with the use of a pneumatic transmitting rotameter or with a purged flow meter transmitter. The transmission of the rate of flow to a centralized control station is not difficult.

The rotameter of porcelain construction was first investigated as a possible way to meter the corrosive liquid. The cost of a large-size porcelain rotameter with a suitable corrosion-resistant float seemed rather high; therefore, it was believed that a more economical metering system could be designed.

The use of a purged flow meter (mercury, diaphragm, and bellows type) was next examined. It was found that there was no suitable purging substance available at or near the metering point. The purged meter was dropped as a possible way to meter the liquid.

Force-balance type. A new type of metering arrangement was needed to solve the metering problem. Investigation revealed that a standard force-balance type small-displacement meter could be so sealed as to prevent the corrosive liquid from coming in contact with the meter. Various designs of a sealed-meter installation were studied. (Acknowledgment is given the Dow instrument-maintenance department for their help on this problem.) The one believed to be generally acceptable is shown in Fig. 5. The main components of the installation are as follows:

1. A force-balance meter transmitter.
2. Two seals with diaphragms of suitable corrosion-resistant material.
3. Two dutchmen (spacers).
4. An orifice plate.
5. Necessary valves and piping.

With reference to the diagram, it is well to point out the following:

1. Each seal diaphragm area is larger than the area of the diaphragm in the meter.
2. The seals should be at the same elevation; if not, an error will be introduced in the meter.
3. From meter to seal, line is filled with ethylene glycol or similar material.
4. A flange designed from angle iron replaces the usual flange on the dutchman side of the black valve. This was done to enable a straight-through pressure tap and to improve the mechanical strength of the valving at the dutchman.

The accuracy of the above metering arrangement depends upon the care of installation and upon the care of sealing the metering. If installed correctly, the accuracy should be 1 to 3 per cent.

7. Flow Measurements of High-Pressure Gas Streams Impeller-Type Flow-Sensing Cell

The problem of measuring and recording process gas flows at pressures above those normally encountered was the subject of recent study. Standard mercuryless meters have been used successfully to measure flows at pressures in the 5,000-psi. range; however, for pressures somewhat higher, flow measurement was considered very carefully. During the early stages of design, various methods of flow measurement were investigated with the impeller-type flow-sensing cell appearing to have the primary device characteristics required. It was desired to measure and record two flows on a single recorder chart with a choice of selection of either one of the flows as a pneumatic control device. Since the controller was to be located in an electrically hazardous area, this prevented the use of an electronic instrument.

The problem was handled by the use of flow cells as primary elements installed directly into the high-pressure piping. The output voltage from each cell was fed into converters, then through electrical conductors into electropneumatic units located near the main control instrument panel. These units are of the servoelectrical pneumatic transducer type which convert microamperes into pneumatic pressure signals. By using this scheme, the pneumatic pressure signals were fed directly into a conventional two-pen recording receiver-controller with control point being manually selected by the operator.

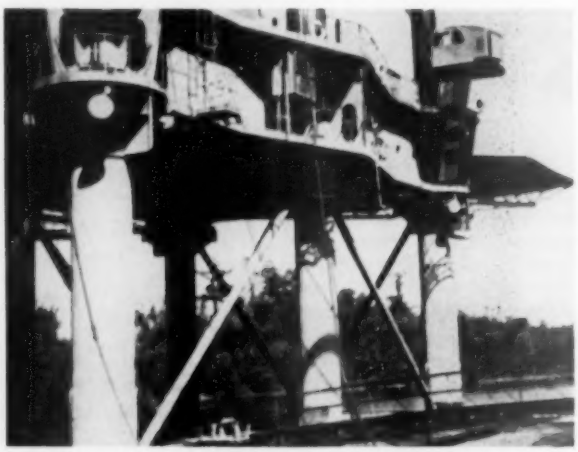
Advantages . . . After satisfactory operation has been proved, it is expected that other units of a similar type will be quite in demand. The advantages of this described system are its simplicity, speed of response, safety, and ease of servicing. Since values from the converters are transmitted by electrical conductors to the electropneumatic units, air piping is omitted and distances do not present normal time lags from the primary element to the controller as in conventional flow-transmission systems. There is no physical connection between the flow-cell sensing coil mounted outside of the high-pressure piping, and this is definitely a safety advantage.

Although it is recognized that the examples given may be known to some engineers active in instrument work, we believe that they do serve to emphasize the interest of petrochemical companies in this subject. It is a common experience to find the most recent instrument developments on trial in various systems as much as a year or more before a formal announcement is made relative to the availability of the device. The instrument engineer is an important part of the successful operation of the highly instrumented petrochemical plants being built today. With the continued close cooperation between manufacturer and user, many tough problems of today undoubtedly will be solved tomorrow.

THIS 120,000-bbl. floating-roof crude-storage tank, one of seven in a Gulf Coast pump station, was treated with the zinc coating in late 1952. The coating is in excellent condition.

STEEL PIPING exposed to the salt-air atmosphere at a small Mustang Island natural-gasoline plant has been protected by the inorganic zinc coating for more than 2 years.

THIS PROTECTIVE CAISSON in open waters of the Gulf of Mexico received a zinc coating about 3 years ago. The coating is still giving excellent protection.



THE COATING IS PROTECTING both the interior and exterior of these tubular stanchions, the bottom and sides of the upper deck, and other exposed surfaces on this large drilling platform.

This Zinc Coating Can Be Applied in Field

New inorganic coating can be sprayed or brushed on. It is being used on many oil-field and refinery installations, and especially in salt-water atmospheres

by D. H. Stormont
District Editor

A ZINC coating which is either sprayed or brushed on steel surfaces—in effect providing a "cold-galvanized" protective sheathing—is offering excellent corrosion resistance at a variety of oil-field and refinery installations.

The unique, inorganic coating appears especially valuable in salt-water atmospheres. At several Gulf Coast installations where it is protecting against salt-water corrosion, the material is outperforming galvanized steels. Unlike many protective coatings, only one coat of the inorganic zinc material is required.

It is giving good service on the decks of floating-roof tanks and on the interior and bottoms of tanks containing crude oil, various refined products, and petrochemicals. On offshore wells it is showing no signs of deterioration after having been applied to the wellheads and caissons more than 5 years ago. It has been applied extensively to drilling barges and platforms, and to coat the hulls and decks of barges in petroleum service.

Around refineries and natural-gasoline plants it is giving excellent service on steel lines near cooling towers, where it protects the lines from the continual splash and spray. At one petrochemical plant now under construction, all structural steel received the inorganic zinc coating in place of the conventional protective paint.

Cost of applying the zinc coating is comparable to the average three-coat job required for corrosion-resistant paints. Because of its long protective life, substantial savings in labor and

maintenance costs appear likely under most weather conditions. There is no evidence of deterioration in coatings applied almost 15 years ago.

Properties of coating . . . The coating was developed in Australia, where first large-scale applications were made before World War II. It is the result of a search for a zinc coating comparable with galvanizing, but one that is not limited by size, shape, and location of the steel surface to be coated, as is frequently the case with hot-dip galvanizing.

The coating is finely ground zinc in a water-soluble silicate vehicle. After being applied by brush or spray, the compound is chemically cured—or as was the case in early applications, it can be oven cured. The material used in chemical curing, a great step in widening its usage, was developed by Amercoat Corp. after the company became the United States licensee.

Available in the United States as "Dimetcote," the zinc coating protects steel surfaces by cathodic protection. It is highly resistant to abrasion. Should a small area be abraded to the bare steel, however, remaining zinc will continue to cathodically inhibit corrosion. Though extremely hard, it is not a brittle film. Normal flexing of steel plate will do no damage.

When the coating is applied to a sandblasted steel surface, a reaction takes place which produces chemical bonding as well as physical adhesion. It is difficult to find the interface between the steel and coating when the latter is properly applied.

Since the coating is zinc, a metal subject to attack by strong acids and alkalies, it is not recommended for strong chemical exposure. It is giving excellent service on the decks of several floating-roof tanks containing sour crudes, however.

Application is a relatively simple process. As with any protective coating for steel, results largely depend on the care with which the steel is cleaned. This is particularly true with the inorganic zinc coating. Intimate contact between the parent steel and the coating is necessary to maintain the electrochemical conditions required in galvanic protection.

The coating is supplied as two components in separate containers, one containing a finely divided powder and the other a solution of silicates. These are mixed at the job site and then either brushed or sprayed onto the sandblasted surface. After the coating dries it is cured by the use of chemicals.

First uses . . . First Australian applications were in 1938. The coating was applied to the dip ring and water seal of a large expansion-roof tank in a Victoria terminal. In 1942-44, it was applied on 163 miles of a 223-mile aboveground water line, 21 to 30 in. in diameter.

After almost 17 years, the coating is still protecting the steelwork of the dip ring and water seal; there have been no maintenance costs. Repairs to the line have been of a minor nature during the 11 years it has been in operation. In most cases patching was on portions of pipe damaged during construction of the line.

Since then it has been applied to practically all large-diameter steel pipe used in major Australian water lines—some 400 miles, ranging in size from 12 to 88 in. All were aboveground in southern areas where the annual rainfall varies from 8 to 24 in., and where temperatures range from 24° to 110° F. Sections of these lines are subjected to the abrasive action of severe dust and sand storms, extreme corrosion in salt tide flats, and to severe grass and brush fires. But the metallic coatings show no signs of damage.

Additional oil-company applications in Australia which have given some 8 years' service include: Undersides of cone and lifter-roof tanks, interior bottom and first ring of storage tanks, condenser boxes, and structural steel work. In all applications where no painting for appearance's sake was done, worth-while savings in paint costs have been realized.

Oil-country uses . . . The coating has been used on a variety of petroleum-industry installations in the United States. Highlighted, they include:

. . . Floating roof decks on seven 120,000-bbl. crude-oil tanks at a pump station on the Texas Gulf Coast. These were treated with the zinc coating in late 1952 and early 1953. The decks were sandblasted and then one coat was sprayed on and chemically cured.

Because of extremely wet weather during the 3-month job, trouble was sometimes experienced in obtaining an effective chemical cure. A few thin spots on two tanks had to be touched up at the conclusion of the job. The work was done on contract for less than 30 cents per square foot of surface coated.

The chemically cured zinc coating on these decks is in excellent condition after 2½ years' service. It is anticipated they will require little maintenance during the next several years. In contrast, painted decks have to be touched up or repainted all too frequently because of water accumulating in low spots and the action of sunlight and weathering.

Because of the perfomance of the coating on these tanks the company late last year applied Dimetcote to seven 120,000-bbl. tanks at the Houston station. In addition to the decks, the inside top ring also was coated. And during the past summer, the exterior shells of the seven tanks were likewise given this protective coating.

Interior walls, bottoms, and undersides of the floating roof of several refined product tanks up to 80,000-bbl. capacity also have been zinc coated. All were in service so that chemical curing was used.

. . . Wellheads and caissons at several offshore fields have been zinc coated in the past 3 years. One major producing company has had all of its offshore caisson-type well guards coated. Many of these are in their fifth year rendering excellent protection. A group of 75 offshore wells in Copano Bay field are in excellent condition after a year's service.

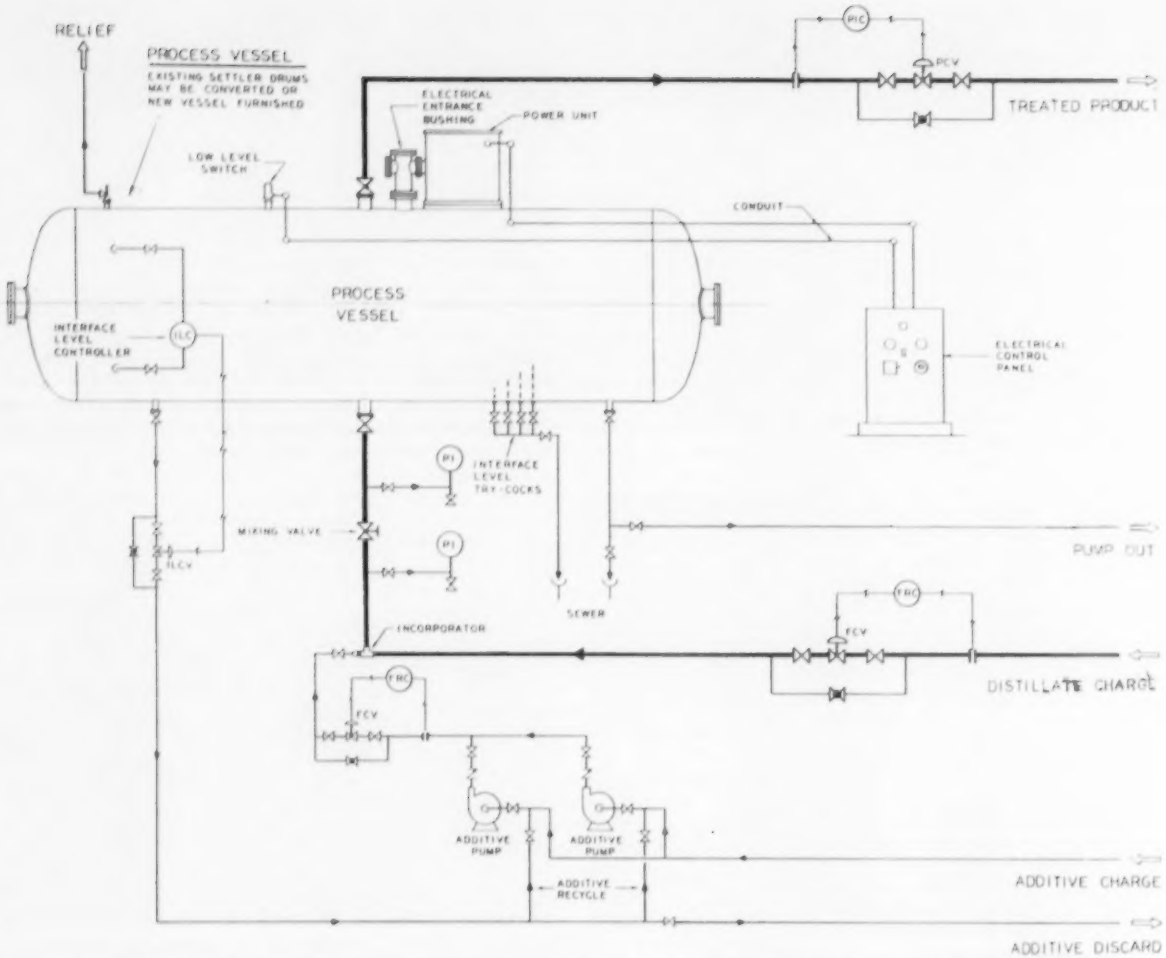
In the latter case, the christmas trees were about 5 ft. above water, with the bradenhead and tidal zone encased in concrete. Dimetcote was applied from the bradenhead up. Moisture and splashing gave little difficulty insofar as proper curing of the coating was concerned.

. . . Other salt-air applications have been on drilling barges, low-temperature extraction units, drilling platforms, and other offshore steel structures. "Mr. Gus," a large drilling platform placed in service last fall, was extensively protected with the chemically cured zinc coating. Both the exterior and interior of the large tubular stanchions interconnecting the upper and lower decks were coated. Likewise the bottom and sides of the upper deck and all structural-steel supports.

One large company had used the coating on piping in and around Gulf Coast cooling towers for several years. It now specifies that all steel within 50 ft. of cooling towers be given the coating. It has proved particularly helpful because of its resistance to continual splash and spray from the towers, and because of its ability to withstand the high input temperatures of 300°-400° F.

Decks and hulls of several barges, tugs, and work boats have received the coating. In addition the interiors of compartments and tanks of vessels hauling various petroleum solvents and products have been given the inorganic zinc coating.

The protective coating has likewise received a limited use in salt-water lines and on the tubing for injection wells in water-flood projects. Much of this experience has been with shallow floods in central and eastern Kansas. Tubing coated more than 4 years ago shows no failures, and caliper logs indicate it is in excellent condition.



TYPICAL TREATING SYSTEM illustrates the basic process needs when using the electrical precipitation method. **Fig. 1.**

ELECTRICAL PRECIPITATION . . .

How to Use It in Treating Distillates

by R. J. Phillips
Howe-Baker Corp.

THE treating of all distillates, from the naphtha to lube-oil boiling ranges, with such agents as caustic, water, and acid can be accomplished more effectively with the aid of electrical precipitation.

Generally, the added coalescing furnished by the electrical field permits lower chemical consumption and a drastic reduction in carryover of addition agent into the treated product.

In addition, the entire treating sequence can usually be greatly simplified with resulting savings in equipment, operating costs, and maintenance expenses. Payout time for the electrical precipitation system is less than 3 months.

Development of Process

Pilot-unit studies using every conceivable type of feed stock have been made on the pilot units located in Howe-Baker's Houston laboratories.

The high point of these studies was the installation, on a temporary basis, of semicommercial 1,500-bbl. per day heating-oil treater in a large Gulf Coast refinery. It was possible to demonstrate on this commercial-type unit the operability of the process.

Subsequent pilot-unit studies have pin pointed the operation variables, including the optimum geometrical configuration for the electrodes, the optimum voltage gradient, the effects of feed-stock composition and the concentration and quantity of treating agent, and such operating variables as mixing energy and temperature.

Status of units . . . The first two commercial units are now in operation at a large Gulf Coast refinery. These units electrically precipitate the mixtures formed in the strong caustic and water washing of catalytic heating oil.

Eight units are now under construction and will go on stream shortly. They are designed for operation involving the electrical precipitation of kerosine, heating oils, and lube oils with such additives as caustic, sulfuric acid, and water.

Engineering studies are in progress on approximately 60 additional units.

Description of Process

In the electrical precipitation technique a high-voltage direct-current electrical field is utilized to resolve emulsions formed in the treating of distillate streams. Since the electrical field will be used, it is possible to mix the distillate and treating agent far more thoroughly.

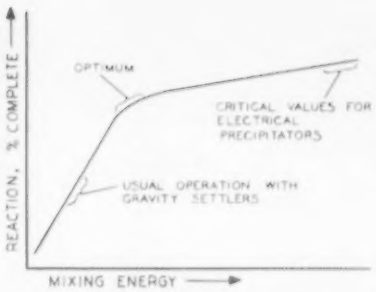
Hence, for a given product quality, a better and more complete chemical reaction can be achieved with considerably lower consumption of treating agent. In other instances, where the refiner has encountered difficulty in maintaining consistently high product quality, the precipitators insure thorough removal of the treating agent with attendant credits. Such problems as those resulting from water haze can be eliminated.

Fig. 1 is a flow diagram of a typical treating system and illustrates the basic process needs of mixing of the feed stock and treating agent, followed by separation in the precipitator.

The process is fully automatic and completely instrumented. It is continuous, thereby eliminating many of the ills associated with batch settling. It is customary to have the treater immediately downstream from the preparation unit (crude distillation, catalytic cracking unit fractionator, etc.).

The distillate feed stock is mixed with the treating agent in an incorporator, followed by a mixing valve. It then enters the precipitator vessel, passes through the electrical field, and out to finished storage. The residual treating agent is continuously removed from the bottom of the vessel and can be continuously recirculated until spent.

The voltage is fixed during startup and there is no occasion for operating personnel to change it. All high-voltage equipment is fully enclosed and explosionproof so there is no danger whatever to operating personnel.



OPTIMUM LEVELS of mixing energy for the different treating processes. Fig. 2.

Process Variables

Considerable development activity has been directed toward studies of the optimum levels of mixing energy for different treating processes, the best means of imparting and regulating the energy, and the effect of the energy on the operation of the precipitator. These conclusions can be drawn:

1. Present gravity-settling equipment does not allow the optimum quantity of mixing energy input since emulsions would result which could not be resolved by gravity settling.

2. Virtually any type of mixing device can be used to impart the required mixing energy in many cases.

3. There is considerable latitude in the minimum amount of energy required to accomplish the desired reaction, and maximum amount that can be tolerated before imposing excessive loads on the electrical precipitator.

Fig. 2 illustrates these principles.

Operating temperature . . . The operating temperature has little effect on the efficiency of the precipitator except in those cases where the feed stock is extremely viscous, such as lube oils. For all distillates from diesels and heater oils to lighter fractions, the precipitator may be operated at whatever temperature is set by plant operators preceding the treating step. In those cases where it is desirable to reduce the water concentration in the treated product to a minimum, it is always advantageous to operate the treater at the minimum possible temperature to reduce the amount of water held in solution. In caustic-washing operations conducted in cold climates, the lower limit of the temperature may be set by the temperature at which the caustic will solidify. For the very viscous feed stocks (e.g. lube oils above 200 S.U.s. at 100° F.) the optimum operating temperature will generally fall within the range of 100°-150° F.

Concentration of treating agent . . . In most treating operations dependent on gravity settling, it is usually necessary to "overtreat" from both the quantity

TABLE 1—EFFECT OF BETTER MIXING, FOLLOWED BY ELECTRICAL PRECIPITATION, ON PRODUCT QUALITY

		Critical test		
Feed stock—	Treated with	Name of test	Untreated feed	Treated products, electrically precipitated
Virgin heater oil	1 per cent of 4 B. NaOH	Neut No.	0.5	0.01
Catalytic heating oil	5 per cent of 25 B. NaOH	Copper No.	18	1.5
Straightrun gasoline	5 per cent of 30 B. NaOH	Copper No.	11	1.0
Kerosine	5 per cent water	Water, K-F	0.22	0.007
Catalytic heating oil	5 per cent of 60 B. NaOH	Phenols, p.p.m.	700	80

TABLE 2—CARRYOVER OF DISCONTINUOUS PHASE INTO TREATED PRODUCT WHEN USING ELECTRICAL PRECIPITATORS

Feed stock—	Treated with	Carryover
Catalytic heater oil	5 per cent of 25 B. NaOH	2.6 p.p.m. sodium as NaOH
Catalytic heater oil	4 per cent of 50 B. NaOH	9.7 p.p.m. sodium as NaOH
	10 per cent of water	0.3 p.p.m. sodium as NaOH haze-free
Virgin heater oil	10 per cent of 10 B. NaOH	1.2 p.p.m. sodium as NaOH
	10 per cent of water	0.4 p.p.m. sodium, haze-free
Kerosine (paraffinic)	10 per cent of 15 B. NaOH	0.6 p.p.m. sodium as NaOH
	10 per cent of water	0.0 sodium, haze-free
Kerosine (naphthenic)	10 per cent of 15 B. NaOH	0.4 p.p.m. sodium as NaOH
	10 per cent of water	0.0 sodium, haze-free
Light naphtha	7 per cent of 15 B. NaOH	0.3 p.p.m. sodium as NaOH
Gasoline, straightrun	7 per cent KOH	0.47 p.p.m. KOH
Gasoline, cat. and virgin mixture	10 per cent of 50 B. NaOH	7.8 p.p.m. sodium as NaOH
Gasoline, cat. and virgin mixture	10 per cent of 30 B. NaOH	2.9 p.p.m. sodium as NaOH
Lube oils:		
50 S.U.s. at 100° F.	20 volume per cent H_2SO_4	0.15 volume per cent sludge
100 S.U.s. at 100° F.	15 volume per cent H_2SO_4	0.2 volume per cent sludge
450 S.U.s. at 100° F.	7 volume per cent H_2SO_4	0.2 volume per cent sludge
750 S.U.s. at 100° F.	12 volume per cent H_2SO_4	0.3 volume per cent sludge

THE AUTHOR

Robert J. Phillips is manager of the distillate treating division of Howe-Baker Corp. After receiving his degree in chemical engineering from the University of Texas, he joined the technical service division at the Baytown refinery of Humble Oil & Refining Co. His work in process design, economic analyses, and operations subsequently netted him promotions to the position of chemical engineer.

In June 1952, he joined Gulf Publishing Co. as operation editor of Petroleum Refiner, from which he was promoted to editor and finally, editorial director. After serving a brief period as a consultant for Howe-Baker, he joined the firm on a full-time basis in December 1954.

and concentration standpoints. The more intimate mixing, followed by more effective separation, made possible by electrical precipitation, usually permits a reduction in chemical consumption of from 30-60 per cent.

Comparison With Gravity Settling

Electrical precipitation has a number of remunerative advantages over gravity settling, many of them obvious, but including:

1. Much lower carryover of the discontinuous phase, whether it be water, caustic, or acid. Tolerances are usually considerably lower than those possible to achieve by gravity settling, regardless of the amount of residence time provided in the latter case.

2. Fully automatic, insuring constant product quality without upsets and surges of carryover.

3. Ease of operation, reducing labor and supervision requirements.

4. Reduction in final and intermediate storage-tank requirements since the charge can come directly from the distillation unit, through the electrical coalescer, and on to final storage without need for intermediate tankage or time in storage before shipment.

5. Reduced operating costs by eliminating the need for salt drying, clay filtration, etc. The only operation costs for the coalescers are the power requirements, which never exceed 5 kva. under normal operating conditions.

6. Reduced chemical consumption in treating operations. Far more vigorous mixing can be used since the electrical field will resolve any normal emulsion where gravity settling would not. This reduction in chemical consumption will usually amount to about 30-60 per cent of the normally required quantities.

7. Reduced pollution, since lower chemical consumption and carryover to tankage reduces chemicals to effluent.

8. Virtual elimination of maintenance, since the electrical precipitators require only routine annual inspections.

9. Improved sludge quality and pumpability, since the process is vapor-tight and air is excluded; oxidation products in sludge are eliminated.

In this typical case, chosen to demonstrate the rapid payout for electrical precipitation, the basis for the economics is as follows:

Feed stock	15,000 bbl. per day of catalytic heating oil
Treated with	5 per cent of 15° B. sodium hydroxide, recirculated

The existing plant has the following sequence:

Caustic wash—water wash—tankage—salt dry—tankage—clay filter—finished tankage

The proposed electrified plant will eliminate the need for the water washing, salt drying, and clay-filtering steps. The existing 10 by 30-ft. caustic-wash vessel will be used for the caustic-wash stage. The treated product will be guaranteed to contain less than 2.0 p.p.m. Na as NaOH, and to be bright (free water less than 0.005 volume per cent) with no visible haze.

Equipment costs . . . Equipment for electrifying the existing vessel, including power supply, electrode assemblies, electrical controls, etc., costs approximately $50,000 installed.

Economic credits . . . These credits result when the process is installed:

1. Reduced chemical consumption. Will reduce caustic consumption from present level of 3.5 tons per day to 1.8 tons per day (based on weight of actual caustic), a savings of 1.7 tons per day. With caustic at $70 per ton, this amounts to $119 per day or 0.8 cent per barrel.

2. Elimination of salt-drying operation. Savings of operating costs of 0.9 cent per barrel or $135 per day.

3. Elimination of clay straining operation. Savings of operating costs of 1.9 cents per barrel or $285 per day.

4. Elimination of water-washing step. Savings of operating costs of 0.2 cent per barrel, or $30 per day.

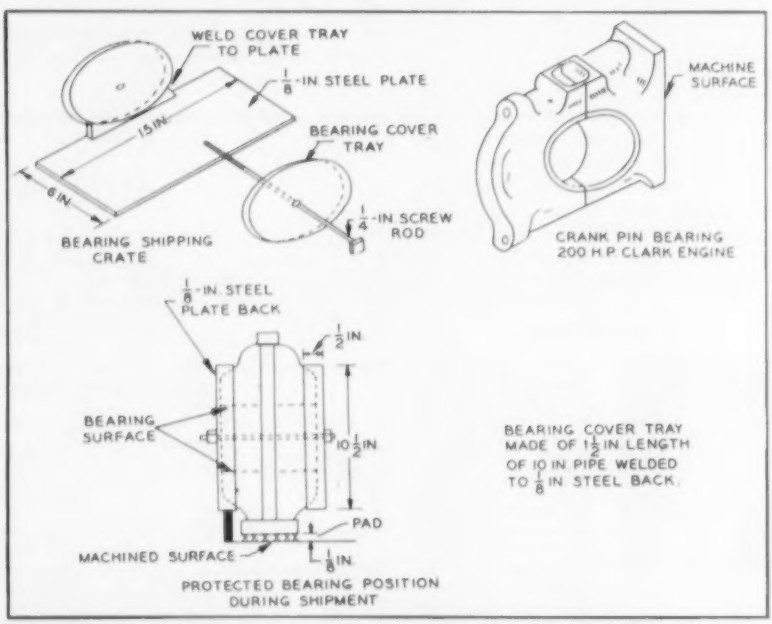
5. Released tankage. Existing intermediate storage tanks are released for other service. They consist of one 80,000-bbl. tank and two 40,000-bbl. tanks, with a total replacement value of $300,000, and a realistically depreciated value of $160,000.

6. Salvage value of equipment. The vessels used in the water-washing and salt-drying operations have an estimated salvage value of $18,000, and the clay-straining equipment a salvage value of $20,000.

The first four items amount to $570 per day or $208,000 per year. Return on $50,000 investment, then, is 416 per cent per year. There is also a nonrecurring credit of $198,000, as outlined in items 5 and 6.

TABLE 3—TYPICAL CATALYTIC HEATER OIL
(Treated with 25° B. caustic soda and electrically precipitated)

Test—	Feed	Product
Copper number	18	1.5
Mercaptan number	15.2	1.47
Sodium content		2.6
A.S.T.M. distillation, °F.:		
I.b.p.	390	
5 per cent	464	
95 per cent	605	
F.b.p.	633	



Designing a shipping crate for crank-pin bearings

PAST practice at Phillips Petroleum Co. was to ship engine crank-pin bearings by merely wrapping them in burlap. But on several occasions, rough handling in transit damaged the machined surfaces and remachining was required.

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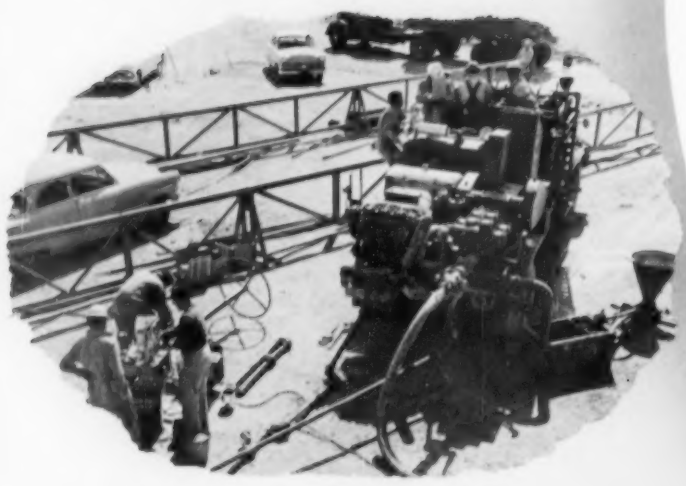

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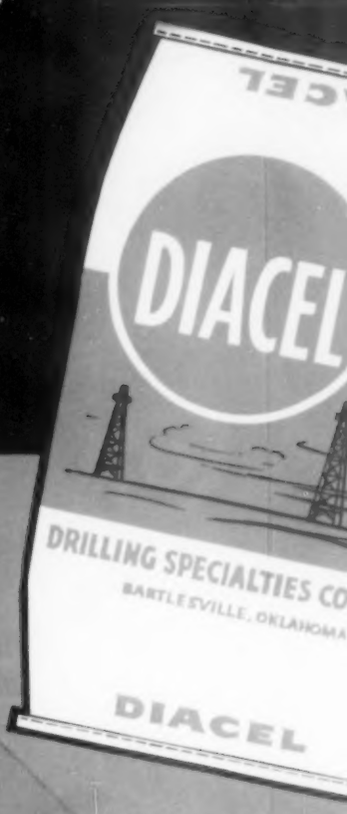

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Differential Refractometer — *for*

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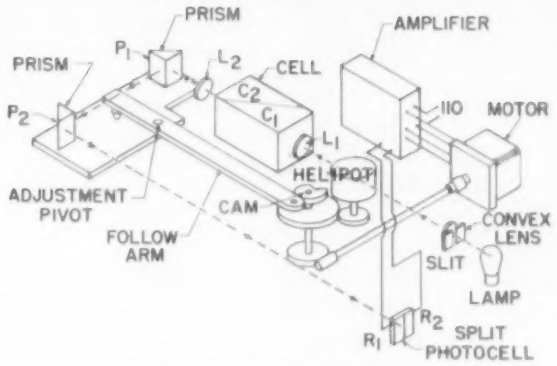


SCHEMATIC VIEW of differential refractometer. Fig. 1.

by O. D. Larrison, F. W. Purl, and H. R. Harris

THE differential refractometer is a simple and versatile instrument with great utility. It has special and almost unlimited applicability to gasoline fractionators, as demonstrated by use on several natural gasoline and petrochemical separations.

Besides the field of fractionator work, applications include reblending of hydrocarbons, mixing of streams for constant feed-stock blends, and detection of contaminates in an uncontrollable stream or process.

Basis for development . . . One of the constant physical properties of any liquid including hydrocarbons, is the refractive index. This phenomenon is additive. A liquid with a refractive index of 1.4 mixed half and half by volume with a liquid with a refractive index of 1.6 would result in a solution with a refractive index of 1.5.

Since gasolines are mixtures of hydrocarbon compounds of the structural classes—paraffins, naphthenes, olefins and aromatics—it follows that there could be, and indeed are, characteristic refractive index values for most gasoline streams. To make use of this phenomenon, it is necessary that the refractive index at the chosen sample point on fractionation column be correlated with the desired, optimum column product.

If it can be shown that this correlation exists, the principle is met on which the refractometer is based, and automatic control is virtually assured. In most cases that have been studied, the refractive index gradient of the fractionator correlates fairly closely with the composition gradient of the heavy component of the separation. There are several column conditions or functions that can usually be correlated with the refractive index of a carefully selected sample point in the column.

Initial boiling points and end points, representative hydrocarbons in the overhead or kettle products, purity of the principal product stream, and the percentage of component being recovered which is lost in the "off" stream are a few of the things that frequently can be correlated with refractive index.

All of these conditions could exist in the same operation, and frequently do, but to varying degrees. A strong correlation with any **one** of them, however, will serve to monitor the quality of production and make an automatic control setup possible.

Construction of the instrument . . . The desire of control fractionating processes by controlling significant refractive indices led to the development of the differential refractometer. Fig. 1 shows an abstracted layout of the refractometer.*

The source lamp S, located at the focal point of lens L_1, furnishes the light that passes through lens L_1, standard cell C_1, sample C_2 and lens L_2. The light is then reflected by prisms, P_1 and P_2, to fall on the two photocells R_1 and R_2. In this position there is an equal amount of light falling on both photocells, and a null condition exists in the servo-mechanisms.

If, however, the sample refractive index changes, the light image is refracted so that it will fall on one or the other of the photocells. The servo-system, thus unbalanced, will act on the photocell signal to rebalance itself. The photocell signal is amplified in the amplifier. This drives the motor and the cam to reposition the light image so that it is again equally divided on the two photocells.

A telemetering system is used which includes a helipot mechanically linked to the cam and varying in resistance with rotation of the cam. This resistance determines the voltage which drives the conventional electronic recorder. The recorder is the transducer of the electrical to air signal which is finally used to vary the process control element.

At one point, the sample and the standard solutions are separated only by an impermeable diaphragm which acts as the pressure equalizer. The sample temperature is maintained near the standard temperature by coiling the sample line through a tank of water and glycol solution.

General Application

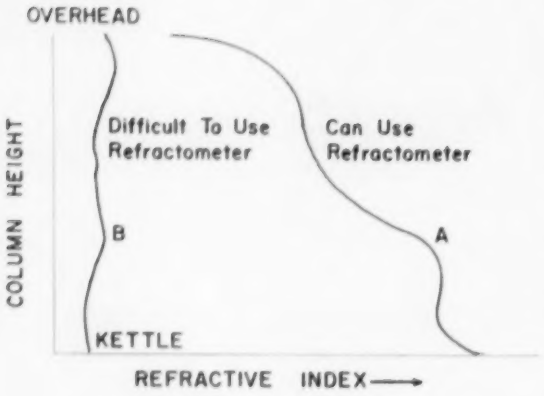
Separation of gasoline blending components demands precise and consistent fractionating processes. It is obvious, for example, that in a normal heptane-toluene separation, it would require very little normal heptane in the toluene to reduce the rich rating considerably. For high volume production, on the other hand, it is necessary to lose some toluene to remove the normal heptane. This loss, however, is undesirable and should be held to a minimum, which requires a very precise separation and consistent operation.

Another example is the separation of cyclohexane and methylcyclopentane. Some loss of cyclohexane is inevitable, but a good, clean, precise operation will hold the loss to minimum and tolerable proportions.

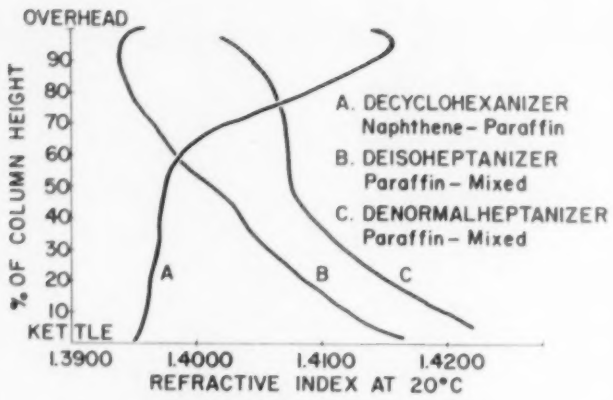
With few exceptions, the refractive index of samples taken at several trays of a column will reveal that the overhead product has a lower refractive index than the kettle product. The gradient between the two is in various

Authors are with Phillips Petroleum Co., Phillips, Tex. Paper presented before A.S.M.E. Instruments and Regulators Division, I.S.A. conference, Los Angeles, 1955.

*E. C. Miller, F. W. Crawford, and B. J. Simmons, "A Differential Refractometer for Process Control," Analytical Chemistry, Vol. 24, No. 7, p. 1087, July 1952.



REFRACTIVE index gradients. Fig. 2.



REFRACTIVE index gradients. Fig. 4.

shapes and forms. Fig. 2 has a normal refractive index gradient in Curve A. The very fact that at some point on this gradient a linear, but changing portion exists, is what makes fractionators particularly adaptable to refractometer control.

There are very few columns separating liquid hydrocarbons which have no difference in refractive index between the kettle and overhead. The few which do not exhibit that difference are the ones that are impossible to control by differential refractometer. In Fig. 2, Curve B is typical of these separations.

Improvements . . . There are several basic improvements a refractometer control system exhibits over manually reset rate-of-flow controllers. Some of these are: continuous analytical information automatically and correctively applied; reduction of laboratory analyses for control purposes; ability to constantly maintain a close separation; and improvement of the feed for the column next in series.

The general way a refractometer is blended into the operational setup can be observed in Fig. 3. From that figure, observe the following signal loop from detector to applier. First the refractometer signals a refractive index change in the sample denoting, let us say, that liquid now being sampled should be lower in the column. The recorder signals an air pressure change to the overhead rate-of-flow controller. The rate-of-flow controller reduces the volume of the overhead product.

This reduction in volume causes the level in the overhead accumulator tank to rise. The liquid level controller on the accumulator tank measures the level change and causes the steam to be reduced a proportionate amount. The steam (heat input) reduction causes correct column operation to be restored and causes the normal sample mixture to be returned to the sample tray. The heat and material balances are then adjusted to maintain a constant composition at the sample point.

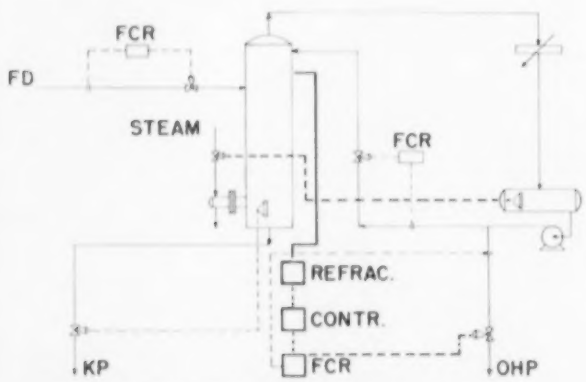
There are a number of basic types of separations to which this kind of control system has been applied. The broadest application has been found in the separation of extremely narrow boiling range fractions of pentanes, hexanes, and heptanes in natural gasoline streams. Columns fractionating light hydrocarbons in the butane boiling range are being controlled by differential refractometers. Several successful applications are in service in petrochemical plants. This field and many others have excellent applications for differential refractometers.

Specific Application

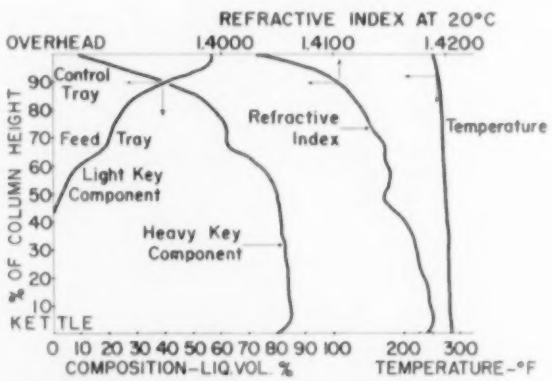
If a potential application fits into one of the listed categories, a refractive index survey of the column is made. Samples from several trays are analyzed for refractive index. These data are plotted as refractive index versus tray number. The region where there is maximum refractive index change from one tray to the next is chosen for the tentative sampling area. Fig. 4 shows the refractive index gradients of some of the present services. Refractive index is plotted against per cent of column height at which the sample was taken, i.e., the twenty-fifth tray of a 50-tray column would be the 50 per cent point of column height.

The very smallest usable refractive index change from one tray to the next in the sample region is 0.00001 refractive index unit. It is better to have considerably more than this, but under optimum conditions the instrument has the sensitivity to utilize that infinitesimal change.

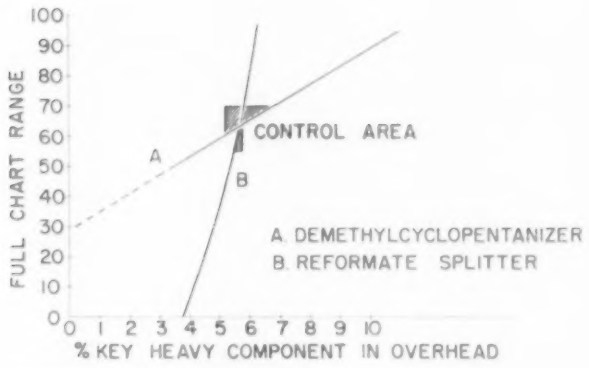
Sampling system . . . If these two conditions are met—liquid sample, and sufficient refractive index change—then



OVERHEAD PRODUCT method of control. Fig. 3.



COMPOSITION and physical-property gradients. Fig. 5.



CORRELATION of chart range with the key heavy component in overhead. Fig. 6.

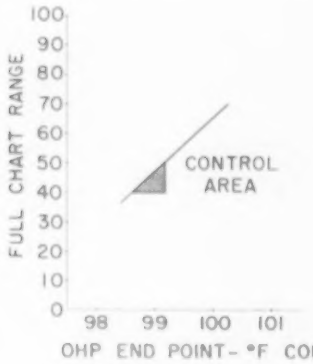


CHART range vs. end point. Fig. 7.

there exists the probability that the refractometer will be able to control the column. After the sample point has been chosen, the next step is the construction of a sampling system.

A bypass system is used with a line from the sample tray passing close to the refractometer and then reentering the system. The point of reentrance must be chosen so the bypass sample will not cause contamination. From the point where the sample line passes the refractometer, the actual refractometer sample is taken off through a small tubing. The sample volume is about 5 to 15 cc. per minute.

The instrument can then begin to record the refractive index changes that occur on the sample tray. All available data is accumulated to find the analytical method and the property of the column that varies with the sample tray refractive index.

Fig. 5 shows some data on a methylcyclopentane - cyclohexane separation. The heavy key component in the overhead has been plotted to show its composition gradient. The refractive index gradient was drawn with it for comparison purposes. The light key component and the temperature gradient were plotted on the same chart with scales chosen to represent the relative sensitivities of the detection instruments. The refractive index gradient has much more slope than the temperature gradient.

In this case, the illustrated separation is fracturing methylcyclopentane as the overhead product — hence the column is called a demethylcyclopentanizer. The temperature and refractive index gradients were plotted on scales showing the entire range of their controlling ability. From the gradients, which should show comparative sensitivity to column fluctuations, it can be readily observed that refractive index would be the better controlling agent.

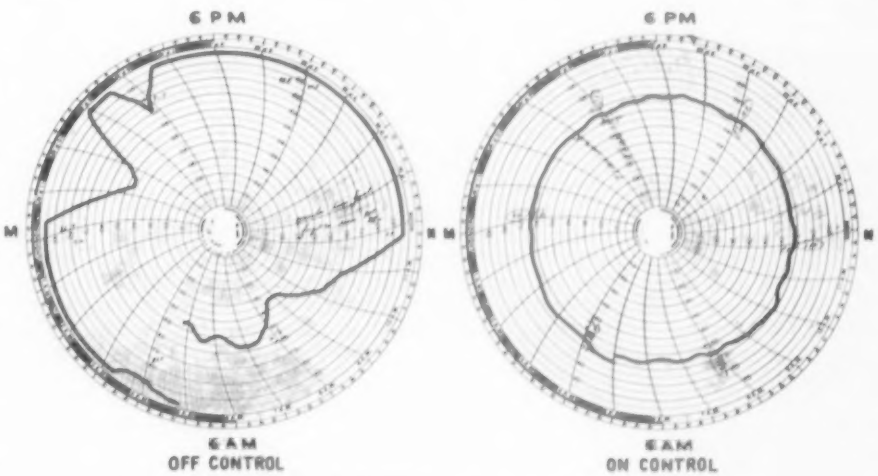
To verify this conclusion, one needs only to show that the concentration of the heavy key component in the overhead varies in proportion with the refractive index of the control tray. To learn whether or not this is true, several dozen samples are analyzed and the analyses plotted against the refractometer readings taken at the time each of the samples was drawn.

Key-component variation . . . Two examples of such a correlation are shown in Fig. 6. Curve A in this figure shows the same demethylcyclopentanizer. As can be observed by this curve, the refractometer is indirectly, but accurately, indicating the per cent of the controlling heavy key component in the overhead product of this column. There is now acceptable data to show that the percentage of this key component can be predicted by only observing the refractometer reading.

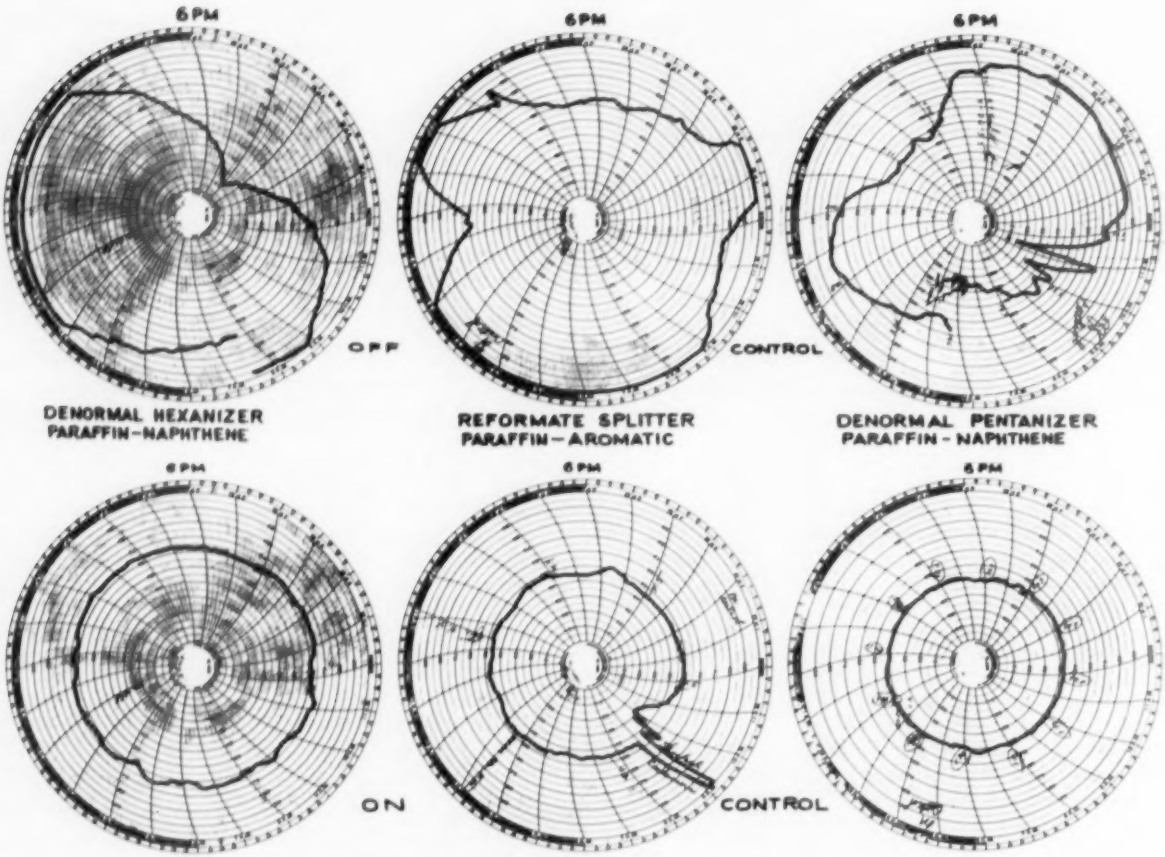
It must follow, then, that if the refractometer can automatically vary the heat input to the column so that the refractive index on the sample tray remains very nearly constant, the significant overhead component will remain very nearly constant.

It was decided that a steady 5 to 7 per cent of the heavy key component in the overhead would make a finer cut than had heretofore been possible or feasible. From the chart, it can be seen that to do this, it is only necessary that the refractometer reading be held between 60 and 70 per cent of its range. If better control could be realized and the refractometer vary less than 10 per cent of its range, that would be even better.

Reformate splitter . . . Curve B in Fig. 6 shows the same type correlation on a catalyst reformate splitter. Here, it was found that the refractometer reading correlated very well with the total amount of toluene lost overhead in a paraffinic - aromatic separation. It was determined that this separation could be controlled to within ±0.15 per cent toluene in the overhead. In other words,



DEMETHYLCYCLOPENTANIZER off and on refractometer control. Fig. 8.



TYPICAL manual and refractometer control. Fig. 9.

the desired percentage of toluene lost overhead could be maintained to within ±0.15 per cent merely by holding the refractometer between 55 and 65 per cent of its total range.

Fig. 7 shows a correlation between the refractometer reading and the end point of a weathering test run on a denormalpentanizer overhead product. Note that the actual control range of 40 to 50 per cent of the refractometer scale will hold the end point within ±0.3° F. Weathering tests are run every 2 hours on some processes to check the quality of the separation.

How they're doing . . . In Fig. 8, the demethylcyclopentanizer is again illustrated. The left figure in the picture shows a typical chart with the column on manual rate-of-flow control. The chart covers a 24-hour period. Note that with the instrument only recording, the refractive index varied over at least 65 per cent of full chart range—actually, there is no way of knowing how far past 100 per cent of its scale it would have gone if it had been able to record in that range.

Assuming that the instrument would have gone no farther than 100 per cent of its scale there would have been a variation of from 3.0 per cent to at least 10 per cent of the controlling heavy key component in the overhead product. The fact is, however, that the analyses on that day of noncontrol showed that the cyclohexane in the overhead product varied from about 3.0 to 21.0 per cent, which is considerable variation.

The chart showing "on control," however, varied only from 63 to 70 per cent of full scale, or only 7 per cent. This is roughly one-ninth as much variation as was experienced on the "off control" day. The variation of the cyclohexane in the overhead product was 1.6 per cent total deviation. This is one-eleventh as much variation as was experienced on the "off control" day. It is significant also that for a temperature controller to keep the column running as consistently as on the control day, it would have to maintain the tray temperature to ±0.7° F. This assumes that a temperature controller could in any way be correlated with the desired operating conditions of the column.

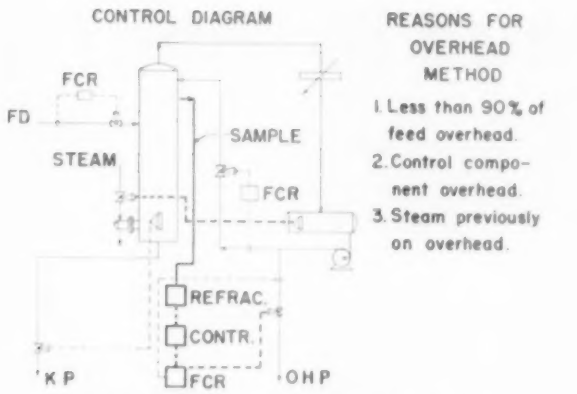
Other separations . . . The information in Fig. 9 shows some of the other separations that are being controlled by the differential refractometer. These illustrate the versatility of the instrument. A denormalhexanizer, catalytic reformate splitter, and a denormalpentanizer are shown. The denormalhexanizer separates normal hexane from methylcyclopentane and cyclohexane; hence, it is a paraffin-naphthene separation.

The reformate splitter separates normal heptane from toluene and some xylenes; hence, it is a paraffinic-aromatic separation. The denormalpentanizer separates normal pentane from cyclopentane; hence, it is a paraffin-naphthene separation. The illustrations that have been shown run the gamut of column services from pentanes to xylenes.

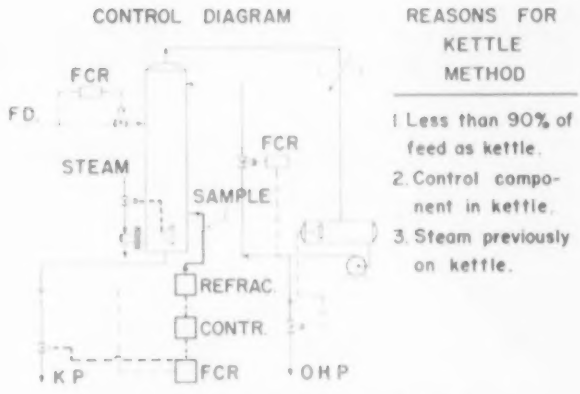
The instrument is also very versatile in its modes of application.

The differential refractometer has been applied to its controlling task in several slightly different ways. In all, it has been used ultimately to control the heat input to the fractionator. The difference is in the route of the signal to the steam motor valve.

Some of the considerations encoun-



OVERHEAD product method of control. Fig. 10.



KETTLE PRODUCT method of control. Fig. 11.

tered in choosing the method of applying the refractometer are: position in the column of the sampling area, ratio of the feed volume to kettle and overhead product volumes, and the product stream in which a key component is controlled. Others of minor considerations are cooling capacity, previous control method, and operator's training. These considerations are all factors involved in the choice of control method.

Overhead-product method . . . In the overhead type of control, the refractometer correctively varies the overhead product takeoff volume resulting in an overhead accumulator level change which adjusts the steam. Fig. 10 shows this type of control. The signal chain is:

Detector (refractometer) to transducer (recorder) to flow controller (overhead rate-of-flow controller) to steam controller (the overhead accumulator level) to steam motor valve (heat input) to sample and finally to detector again.

The type of control in Fig. 10 is usually used if these general conditions exist:

1. When less than 90 per cent of the feed is going into the overhead product.

2. When the concentration of a key component in the overhead product is controlled.

3. When the previous control system employed rate of flow control of the overhead product. This saves the expense of additional instrumentation.

Kettle-product method . . . The kettle-product method in Fig. 11 differs from the overhead method only in that the kettle product rate-of-flow controller and the kettle level are used to vary the steam. The signal chain as shown in Fig. 11 is:

Detector (refractometer) to transducer (recorder) to kettle product rate-of-flow controller to steam controller (kettle level) to steam motor valve (heat input) to sample to detector.

The type of control system in Fig. 11 is generally used when these conditions exist:

1. When less than 90 per cent of the feed is kettle product.

2. When the concentration of a key component in the kettle product is controlled.

3. When the previous control system employed rate-of-flow control of the kettle product.

These two control types are the ones commonly used. They make use of an instrumentation principle known as "cascading." That is the indirect routing of the signal from detector to the process variant. This system is harder to upset than the more direct methods and the upsets are less violent. The cascade acts as a dampener.

Other systems . . . There are other control systems that have been employed with the refractometer to lesser extent—the column pressure drop method, the reflux method, and the direct steam control method. All these make use of the cascade principle except the direct method.

As a general rule, these methods are never used unless the first two methods prove impossible to apply.

Operator Education

The problem of applying the instrument can be considerably simplified by giving the fractionator operator the opportunity to learn about the instrument as quickly as possible. He should receive instructions in every phase of the instrument so that he fully understands its usefulness and its limitations and how it will enhance rather than impair his position. He should learn to recognize malfunctions as opposed to correct, but abnormal, deviations. The instrument man and the operator, working together, can be far more successful than either alone could hope to be.

Calibration charts showing desired operating performance should be available. A working knowledge of the instruments, component parts and the manner in which the instrument performs its tasks should be made clear to him. He should know the instrument's normal limitations; that is, at what point it should be taken off control and at what point it should be returned to automatic operation.

Maintenance

A separate maintenance-application group is responsible for the correct operation of about 10 refractometer installations as well as partial responsibility for some other automatic analyzers used in the area.

They assume problems of correlation, installation, and integration with existing controls. They make available desired information to process operators, and they do all the routine and preventive maintenance required by the instruments.

They take and interpret as much analytical data as is possible and work with process engineers in selecting and developing new applications.

Preventive maintenance . . . There are electronic failures such as tubes, source lamps, and photocells that regularly occur. The regularity can be established, so that it is possible to periodically or conveniently replace components that would probably expire shortly. With such a schedule, there are far fewer chances of surprise instrument failures which can cause serious column upsets. Following is a list of some of the things that can be done by schedule:

1. Oiling, according to oiling chart.
2. Cleaning slide wire.
3. Cleaning sample filters.
4. Replacing source light.
5. Battery changes (in recorder).
6. Tube changes.

Why Aerated-Mud Drilling?

Here are seven reasons for looking into it

by Roy A. Bobo,* R. S. Hoch,† and George S. Ormsby‡

AERATED mud drilling is a way to increase drilling rates over straight mud drilling. It has the desirable features of air and gas drilling where bottom-hole pressure against the formation is kept low. But it has many advantages over straight air drilling. For example:

1. Low permeability water zones and "weeping shales" can be tolerated with no danger of sticking the drill pipe.

2. It is safer. By cutting off the air injection and increasing the rate of mud input, a fast buildup of weight in the annulus can be achieved when needed.

3. The problem of wall-sloughing when converting a dry-walled hole to mud is eliminated.

4. Cuttings, since they remain with the mud phase, are larger and more convenient to sample.

5. The ready availability of mud-circulating equipment greatly speeds sealing of water zones.

6. For those who may consider it a real hazard, the possibility of down-hole explosions or fires is eliminated by the free moisture entrained in the air phase.

7. Hole deviation may be less, owing to mild sleeve-bearing effect of the liquid phase between the drill collars and the bore hole wall.

Authors are: *director of drilling engineering division; †associate engineer, drilling tools; and ‡assistant director of drilling engineering division, all with Phillips Petroleum Co.

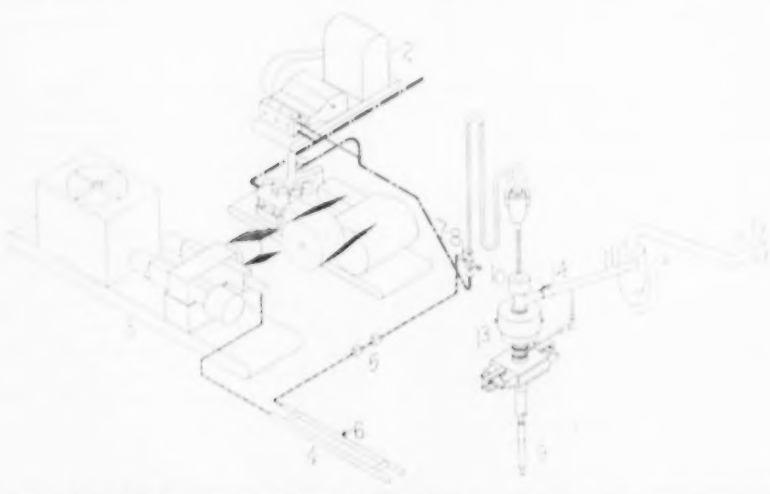
Material presented by G. S. Boudreaux, assistant division engineer, Phillips Petroleum Co., before 15th annual meeting, American Association of Oilwell Drilling Contractors, September 28, 1955, Houston. The original title was "Aerated Mud Drilling."

For the original articles of the field results with aerated muds, see The Oil and Gas Journal, January 24, 1955, page 82, and February 7, 1955, page 104.

Equipment . . . For aerated-mud drilling, the equipment used is a combination of that used in conventional mud drilling and a suitable air compressor. Since our intention is to use this method of drilling from the surface to depths well below 10,000 ft. (and we have twice drilled with aerated mud to 9,600 ft.), this paper will describe the equipment necessary to convert a two-pump compound, 10,000-ft.-or-better rig from mud to aerated mud drilling. Fig. 1 shows the principal equipment items.

Note that one of the standard mud pumps is removed from the rig entirely, while the other has been kept on the compound. This pump (1)* on the compound is available for conventional mud drilling and for killing the well in an extreme emergency. To the rig has been added a separately driven 1,500-psi. mud mup (2) with outputs ranging from 25 to 300 g.p.m. This pump furnishes the mud phase during aerated-mud drilling.

*All such numbers refer to Fig. 1



BASIC EQUIPMENT for aerated-mud drilling include compounded air compressor and separately driven mud pump (3 and 2). Compounded pump is used for conventional mud circulation. Numbered equipment described in text. Fig. 1.

Compressor unit . . . The compressor (3) is a 550-hp., belt-driven, skid-mounted Clark Bros. unit, with automatic controls. It is connected to the compound drive formerly utilized by the second mud pump. The machine is rated at 2.125 M.M.c.f.d. at 600 psi.; 1.80 M.M.c.f.d. at 1,000 psi.; and 1.54 M.M.c.f.d. at 1,500 psi., all at 13-psi. inlet pressure.

Auxiliary compressor equipment includes a 39-cu.-ft. surge tank (4), two piston-type check valves (5), a safety pop (6), and a high-pressure air closing valve (7). The surge tank limits the rate of pressure buildup in the air-discharge line during the time required for the automatic controls to unload the compressor after the valve (8) has been closed.

To the conventional drill-string equipment has been added a flapper-type check valve (9), which is placed one joint below the kelly after each trip and serves to prevent back-flow during each connection. Straight-hole instruments can be pumped through this valve, and wire-line tools can be run through by employing a special sleeve.

Air control . . . A rotating head (10) is installed as close under the rotary table as possible. Stock rotating heads are bulky, expensive to maintain, and generally unsatisfactory because they are not designed for the low pressures and long rotating periods associated with continuous aerated-mud, air, or gas drilling. As a result, makeshift rotating heads have been used. The makeshift low-pressure heads proved more satisfactory in field trial than did one of the standard commercial brands.

Return flow from well passes through a flow line into a separator (11), where the air and mud phases are separated. The air is removed at the top and transported a safe distance from the rig through either of two vent lines (12) made of light, collapsible material for easier portability. The

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mud and entrained cuttings are discharged through the bottom of the separator and directed over the shaker screen. The vent line is so sized that only a few feet of water head will be exerted within the separator for maximum anticipated air and gas flow. Flow lines should be kept as large as practicable—at least 10¾ in. in diameter in order to maintain a pressure at the rotating head less than ½ psig.

Although mud pits (or tanks) are not shown in Fig. 1, the maximum tank-storage capacity should be equal to the minimum hole capacity plus 100 bbl. This large surface volume is needed to fill the hole with mud prior to making trips and in emergencies.

Starting up . . . When aeration is to be started, as after trips, assuming that the hole has been filled, straight mud is first circulated using the small, independently driven pump at a rate sufficient to lift cuttings in the annulus. An annular velocity of 100 ft. per minute is usually safe. The standpipe air valve is then opened and the aerated column starts down the drill pipe. Because the weight of this column is less than the weight of the straight mud in the annulus, the standpipe circulating pressure increases as the mixture goes down the drill pipe, approaching a maximum as it nears the bit.

After the aerated column passes the bit and starts up the annulus, the standpipe circulating pressure begins decreasing. It drops gradually at first, then faster as the expanding mixture approaches the surface. The last few minutes of this "unloading," as it is called, can be violent if too much air is circulated on the first pass around bottom, or "kick-off." Probably about a 1,000-M.c.f.d. initial rate will be found to be an optimum for kicking off.

Immediately after the first air reaches the flow line, full compressor-capacity injection is started into the standpipe and the mud pump is slowed down to the rate found to be best for the drilling conditions. It is then necessary to adjust the weight on the bit because the hook load will have increased due to losing the buoyant effect on the drill pipe of the displaced mud. Aerated-mud drilling is now under way, with the standpipe circulating and the bottom-hole drilling pressures at their lowest values.

Making connections . . . To make a connection, the air valve is shut off at the standpipe and the mud pump is run long enough for straight mud to reach the drill-string check valve. This valve is never farther down the hole than the footage drilled with one bit. The rig compound pump can be clutched in to shorten this time if desired. The pumps are then stopped, the standpipe bleed line is opened to make sure no air is trapped under pressure, and the connection is made as in straight mud drilling. Connection time for aerated-mud drilling has averaged the same as for straight mud.

The rotating head requires no attention on connections unless gas is being produced from the hole. In this case, safety would require that the stripper preventer (13) below the flow line and the butterfly valve (14) in the flow line be closed before the kelly is pulled out of the rotating head. This will prevent gas seeping out under the floor during a connection.

After the connection, the mud pump is started at the pumping rate used for drilling, the air valve is opened to the standpipe, and drilling is resumed.

Making use of mud . . . Depending on conditions, it may be desirable prior to trips to shut off and displace the air from the hole with a high mud rate. This may be advisable for the following reasons:

1. It eliminates any tendency of the

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annulus to blow air or gas during the trip, or while the drill pipe is out of the hole.

2. The ability of the formations to support a solid column of mud can be checked.

3. An opportunity to seal off water-producing formations or lost-circulation zones is afforded.

4. Hole-deviation instruments are of doubtful accuracy in aerated-mud solutions, apparently due to the continued movement of fluid at the bit after circulation is stopped at the standpipe.

5. Pit volume is reduced enough to permit thorough cleaning of all pits with a minimum loss of mud.

If lost circulation is serious, it may not be practical to completely displace the air from the hole, but mud should always be pumped to the bit.

During each trip, a joint from the top of the drill string is placed immediately above the drill collars. This joint is inspected for corrosion on the next trip.

Should a high-volume gas or oil zone be encountered, making it desirable to kill the zone, the procedure is as follows: (1) shut the air valve; (2) clutch in the rig compound pump; (3) close the stripper preventer and the flowline butterfly valve, diverting flow through positive chokes; (4) pull the kelly up out of the rotary, and (5) continue circulating through the chokes until the formation flow ceases.

Peculiarities . . . The aerated-mud drilling process differs in many ways from conventional mud drilling.

During drilling operation, the standpipe circulating pressure is much lower than in straight mud drilling. This is because the compressed aerated-mud column in the drill pipe weighs much more than the expanded aerated mud column in the annulus. In fact, the standpipe circulating pressure is much lower than the pressure drop across the bit alone.

The bottom-hole pressure in the annulus is mainly dependent upon the air-to-mud ratio. As the air-mud ratio increases, the bottom-hole pressure decreases. The increase in bit-penetration rate experienced with air, gas and aerated-mud drilling depends primarily upon this decrease in bottom-hole pressure, compared to straight mud conditions.

In drilling with any compressible medium, the annular velocity varies from the bottom of the hole to the top. In aerated-mud drilling with better than 2 M.M.c.f.d. of air available, annular velocities will range from about 180 ft. per minute at the bottom of an 11-in. hole to a maximum of well over 5,000 ft. per minute at the top of an 8-in. hole.

"The aerated-mud drilling process is versatile and flexible to meet widely varying conditions. Drilling may be with all air or all mud, or any desired mixture in between."

The aerated-mud drilling process is versatile and flexible to meet widely varying conditions. Drilling may be with all air or all mud, or with any desired mixture in between. Thus the bottom-hole drilling pressure may be selected.

Until now, lack of suitable compressor equipment has hampered employment of the method. Now this equipment is becoming available. It is the authors' hope that both contractors and companies will join in further development of aerated-mud drilling, to the end that over-all drilling and exploratory costs will be markedly reduced.

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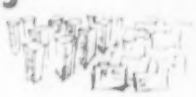

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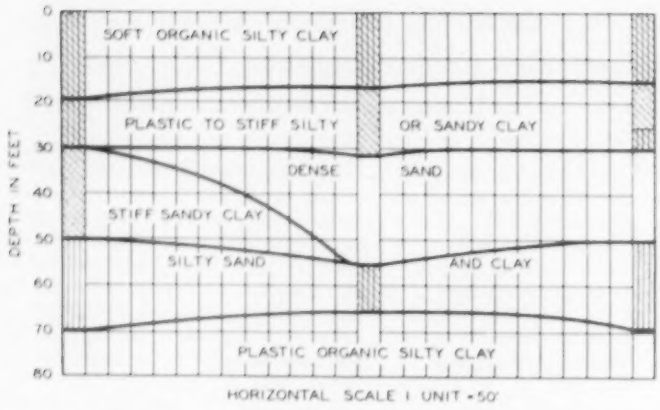
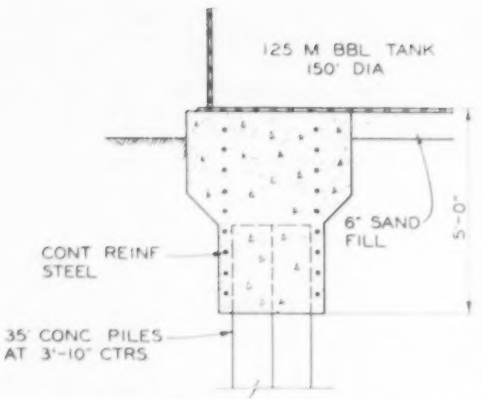


PLOT OF DATA from borings shows how soil varies across tank site. Fig. 1.



THIS CONCRETE RING, shown here in cross-section, was used to support big tank. Fig. 2.

How Phillips designs

Tank Foundations for Weak Soils

Three foundation designs are used at one terminal . . . concrete mat with piling, concrete ring with piling, and crushed-rock fill. All three are very satisfactory

by J. R. Sellers
Phillips Petroleum Co.

THREE different types of foundations for floating-roof storage tanks have been used successfully at Phillips Petroleum Co.'s Freeport terminal. Soil conditions here varied considerably within a 35-acre tankage area and the clays and silts in the upper layers are weak and highly compressible.

Complete soil investigations for each tank location have been the key to economical foundation design and have reduced foundation costs approximately 70 per cent compared to the original type of foundation used in the terminal area.

Several factors influence the design of tank foundations where weak and highly compressible soils are found in the subgrade. In general, foundation requirements are that the tank should be safe against total or partial failure; the differential settlement should not be large enough to hinder the function of the floating roof; the total settlement should be predicted with reasonable accuracy in order to establish proper tank grades; and the connecting piping should be flexible if settlement is expected.

Soil characteristics . . . Phillips' Freeport terminal is located adjacent to the mouth of the Brazos River near the city of Freeport, Tex. The foundation soils in this area consist of the Beaumont clay of Pleistocene age and alluvial deposits of the Brazos River. The river deposits are generally silty or sandy and often contain an excessive amount of organic material. These deposits are found in a loose and soft state and are often overlaid with a layer of highly organic clay.

The depth and thickness of the alluvial deposits vary appreciably within the terminal area as shown by the three borings in Fig. 1. The soft-to-plastic organic silty clays in the upper 20 ft. are the primary source of trouble as far as foundation design is concerned. The cohesion, which is equal to one-half the unconfined compressive strength, averages about 400 lb. per sq. ft. The moisture content varies from 35 to 45 per cent and the unit dry weight varies from 85 to 90 lb. per cu. ft. The liquid limit and plastic limit are about 0.85 and 0.25 respectively. The void ratio is generally in excess of unity.

Factors which influence type of foundation to be used where weak compressible soils are found include total and differential settlement, bearing, and plastic flow.

In order for a floating-roof storage tank containing gasoline or other volatile liquids to function properly, the diameter of the tank must remain fairly constant. Excessive variation of the tank diameter or egging of the tank shell will cause binding between the floating roof and the tank wall. Egging of the shell also increases the possibility of damaging the flexible vapor seal between the roof and the tank wall. If the vapor seal is not maintained, the product in the tank will vaporize and a loss of product will occur. The amount of differential settlement which a floating-roof tank can undergo and still operate satisfactorily is a function of the tank diameter. Permissible differential settlements increase as the diameter increases.

When differential settlement becomes objectionable, then it is necessary to relevel the tank shell. It is not a difficult task for an experienced crew to relevel the outside rim of the tank by jacking and tamping crushed rock under the rim. Releveling increases maintenance costs, but it is a method to correct differential settlement. Where settlements of this nature are expected, periodic checks should be made to ascertain when the releveling is re-

quired. Large uneven settlements will induce high localized stresses in the tank shell.

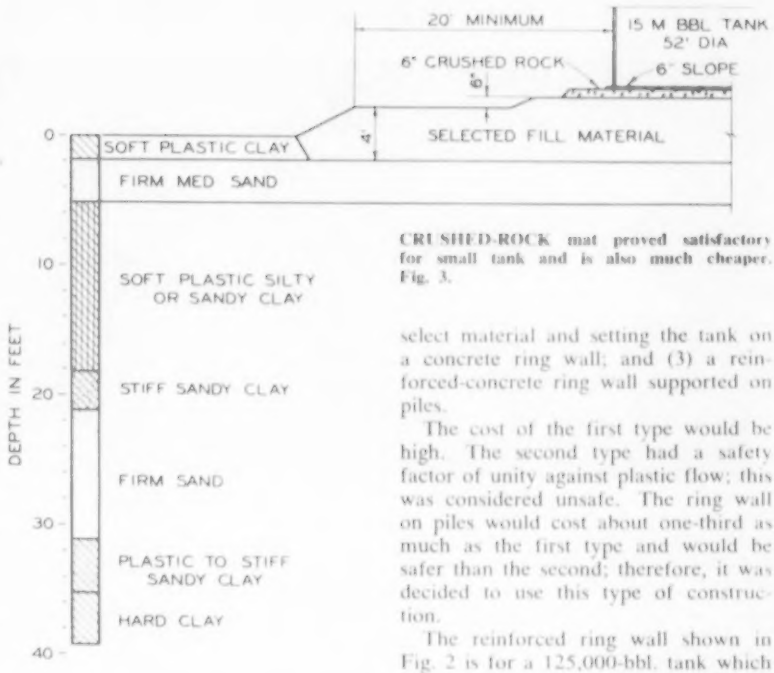
Settlement of the tank is not particularly harmful provided it is uniform. If settlement is expected, the piping connected to the tank will need to be flexible enough to accommodate the movement of the tank. In order to determine the flexibility requirements of the piping the total settlement of the tank must be predicted with reasonable accuracy.

It is also desirable to know the total settlement of the tank in order to establish a tank grade that will be above the surrounding grade after the settlement has ceased. This is necessary for adequate surface drainage which will minimize corrosion and help maintain a drier foundation base.

The top layers of soil are generally the weakest and the possibility of local shear and plastic flow failures may be the design criterion. This type of failure is due to the high load concentration at the rim of the tank and a weak surface layer. Failure would probably occur over a portion of the tank perimeter and could be rather sudden. Soil flowing laterally from beneath the bottom rim allows the rim to drop, setting up high localized stresses which could possibly rupture the shell. This could result in a loss of product or tank or both.

Where the subsurface soils are predominantly clay, the center of the tank will settle more than the outside rim. In order to eliminate the possibility of the bottom of the tank becoming bowl shaped, this difference in settlement should be calculated and the center of the tank bottom raised this amount plus an added amount to provide for adequate drainage within the tank at all times. As a rule, the tank bottoms have sufficient flexibility to be constructed in a coned shape and still not be overstressed due to subsequent settlement.

The first tank foundations in the terminal area were constructed prior to the time Phillips acquired the property. The foundations for these tanks were



CRUSHED-ROCK mat proved satisfactory for small tank and is also much cheaper. Fig. 3.

24-in.-thick reinforced-concrete pads which were supported by 45-ft.-long timber piles driven on 3-ft. 6-in. centers. For a storage tank with a capacity of 100,000 bbl. this would require about 1,300 piles and 800 cu. yd. of concrete at a cost of $175,000 based on present prices.

This type of foundation has a very high factor of safety against overloading the foundation soils. The reinforced concrete mat would tend to equalize differential settlements. This type would be perfectly safe and stable and would not interfere with the operation of the tank, but the cost is high.

Where soil conditions permit tanks to be placed directly on an earth or gravel berm, which is generally done in the Central Plains area, foundation costs are less than 10 cents per barrel of storage capacity. Foundation costs for a 100,000-bbl. storage tank supported on piles capped with a reinforced-concrete pad would be $1.75 per barrel of storage.

Specific Designs for Freeport

In 1948, Phillips planned to increase the storage capacity of the Freeport terminal. An investigation of the cost of foundations used previously in the terminal area led to a thorough soil investigation and consultation with foundation experts in order to design the most economical type of foundation.

The three types of foundations considered were: (1) Piles on 3-ft. 6-in. centers capped with a 24-in.-thick reinforced-concrete mat; (2) replacing approximately 4 ft. of the top soil with select material and setting the tank on a concrete ring wall; and (3) a reinforced-concrete ring wall supported on piles.

The cost of the first type would be high. The second type had a safety factor of unity against plastic flow; this was considered unsafe. The ring wall on piles would cost about one-third as much as the first type and would be safer than the second; therefore, it was decided to use this type of construction.

The reinforced ring wall shown in Fig. 2 is for a 125,000-bbl. tank which has a diameter of 150 ft. and a height of 40 ft. The ring wall extends around the periphery of the tank and is supported on 35 to 40-ft.-long, 16-in.-square, tapered reinforced-concrete piles. The piles were driven on 3-ft. 10-in. centers with the diagonals of the piles placed perpendicular to the radius of the tank.

The ring wall and piles support the wall of the tank and a part of the liquid load, transferring these loads to the better foundation soils 30 ft. below the surface. A band of soil 4 ft. wide or more is relieved of its vertical load, thereby increasing the resistance to lateral flow from under the tank. The piles and the concrete ring wall, which extends 4 ft. below grade, tends to restrain the soil from flowing laterally. The piles decrease the area through which the soil can flow by about one-half.

The advantages of the ring wall are a reasonable first cost, a safe design, and a minimum of differential settlement. The cost of this type of foundation for a 100,000-bbl. tank has been approximately 50 cents per barrel of storage. Since 1948 several have been constructed and the performance thus far has been satisfactory.

Grades for small tanks . . . In 1952 it was planned to add two 15,000-bbl. tanks at the Freeport terminal. Further soil investigation at the proposed location of the tanks revealed a 3-ft.-thick layer of sand 2 ft. below the ground surface. Preliminary calculations indicated that the sand layer might be used to spread the tank and liquid load to

THE AUTHOR

J. R. Sellers graduated from Oklahoma A. & M. College in 1948 with a B.S. degree in civil engineering. Prior to finishing school he had worked in the South Pacific for 2 years with a Naval Construction Battalion. Sellers joined Phillips immediately after graduation and has spent the past 7 years in structural design of various petroleum-industry facilities. His present position is supervising structural design engineering in Phillips' engineering department.

CANADIAN OIL COMPANIES, LTD., EXECUTIVE APPOINTMENTS

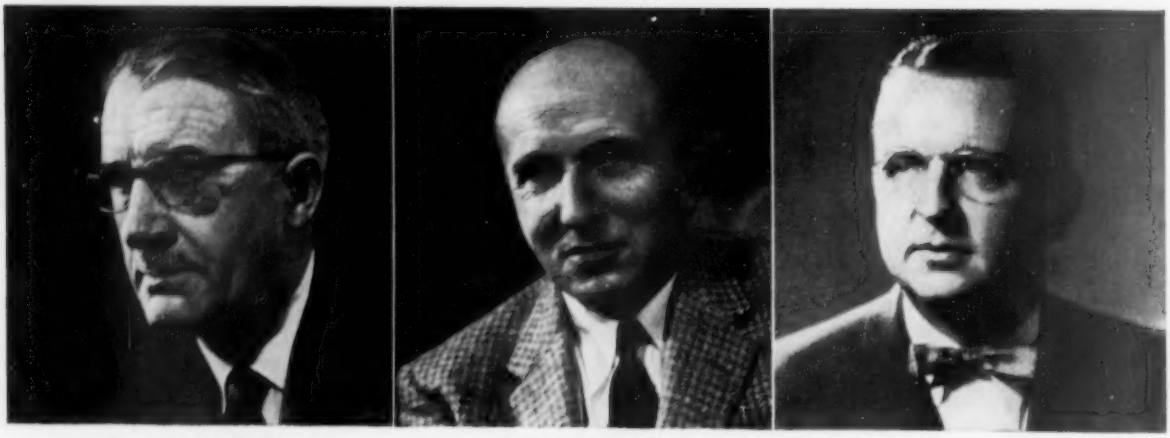


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TABLE 1—SETTLING RECORD OF 15,000-BBL. TANK AT FREEPORT TERMINAL

	Elevation in feet							
Location, outer rim	Oct. 27, 1953 Empty as constructed	Oct. 29, 1953 Full of water	Oct. 30, 1953 Full of water	Nov. 11, 1953 Empty	Jan. 7, 1954 Full of products	April 6, 1954 33 ft. 1 in. of gasoline	Oct. 15, 1954 30 ft. 4 in. of gasoline	May 18, 1955 27 ft. 8 in. of gasoline
North	12.59	12.39	12.32	12.30	12.19	12.21	12.15	12.09
East	12.59	12.47	12.42	12.37	12.28	12.30	12.25	12.17
South	12.60	12.47	12.42	12.35	12.25	12.25	12.20	12.11
West	12.56	12.36	12.28	12.26	12.15	12.16	12.11	12.05

the soft clay below, eliminating possibility of local shear failures.

The tank could be placed on a crushed-rock pad. Thus, much money would be saved by eliminating the reinforced-concrete ring wall and piles which had been used previously. The soft surface material directly above the sand would have to be replaced with select material.

Twelve additional soil borings were made at each tank location to determine the extent of the sand layer and to verify its depth. The sand was found to be fairly uniform in depth and extended entirely over the area where the tanks were to be located. To have a safety factor of two against local shear failures, it was determined that the soft organic clay above the sand should be removed and replaced with 4 ft. of select material which would extend a minimum of 20 ft. beyond the wall of the tank. A 6-in. crushed-rock pad would be placed on the fill to support the tank and its contents as shown in Fig. 3.

Total settlement of the center of the tanks was predicted to be approximately 9 in. The center of the tank was crowned 6 in. to allow for differential settlement between the rim and the center. The rim was raised 6 in. above finished grade to allow for the total settlement. The fill and discharge lines to the tanks were made flexible by using piping offsets and Dresser couplings to provide for the expected settlement of the tank. Estimated savings per tank compared with the reinforced-concrete ring and wood piles was $4,200.

Two tanks were completed in November of 1953. Settlement records are shown in Table 1. The settlement thus far has been approximately uniform, and after the initial settlement which took place during testing, has been rather small.

Greer-McClelland, of Houston, performed the soil investigation with Prof. Raymond F. Dawson acting as a consultant. Personnel of the refining and engineering department of Phillips Petroleum Co. collaborated in the final design and construction.

BOOKS

TULSA GEOLOGICAL SOCIETY DIGEST, Vol. 23 (1955). 350 pp. Published by the Tulsa Geological Society. Available from J. R. Maxey, publication business manager, Jenkins Building, Tulsa. Price $2.25.

The Tulsa Geological Society has again produced a very fine digest with many papers that are of immediate interest to petroleum geologists. Summaries are given of all geological papers presented before the society during 1954-1955 meetings. These summaries are abridged versions of the talks presented rather than mere abstracts, and are well illustrated. In addition to the geological papers, the digest contains two master's theses and a complete list of geological theses that have been written at the universities of Oklahoma, Tulsa, Kansas, Missouri, Arkansas, and Texas. The master's thesis entitled "Insoluble Residue Study and Correlation of the Arbuckle Group in Southern Oklahoma" is of particular value to petroleum geologists because of the recent successful production tests from the Arbuckle limestone in southern Oklahoma. This thesis contains detailed description of the insolube residues from type areas in both the Arbuckle and Wichita mountains.

The geological papers that are included cover a wide range of subjects, from geology and oil development of Grayson County, Texas, to uranium exploration. All told, some 28 papers are included in the Digest.

NATURAL GAS STATISTICS. By Richard C. Henshaw, Jr. Published by the Bureau of Business Research, University of Texas, Austin. 127 pp., paper cover, $2.

Aimed at providing the most useful and up-to-date information available in the field of natural-gas economics, this book is a supplement to the recently published monograph, "Economics of Natural Gas in Texas." The supplement, however, covers the entire industry throughout the nation. It breaks industry activity down into useful divisions for statistical study.

The statistics presented in charts, tables, and drawings cover virtually all the important aspects of the natural-gas industry. The figures given show trends in production, pipelining, storage, etc. They comprise a handy reference source for a very broad range of information about natural gas. In short, here is a handy reference manual for anyone interested in the scope and form of the gas industry.

PROCEEDINGS OF THE CONFERENCE ON LATIN AMERICAN GEOLOGY. Edited by Fred M. Bullard. Published by the department of geology, University of Texas, Austin 12. 100 pp.

Nine geological papers were presented at the Conference on Latin American Geology held at University of Texas this spring. This hard-bound book presents those papers. Subjects covered included: (1) Outline of Petroleum Geology of Mexico; (2) Metallic Ore Reserves of Mexico; (3) Geological Development of the Colombian Andes; (4) Some Geological Problems of Northern Maturin Basin, Eastern Venezuela; (5) Mineral Deposits of Brazil; (6) Gravity of Colombia: Gravity As a Reconnaissance Geological Tool; (7) Geology and Petroleum Developments in Brazil; (8) Contributions and Aids by Geographers to Latin American Geology and Geologists; and (9) Research on Central American Volcanoes and the Work of the Committee on Vulcanology, Pan American Institute of Geography and History.

Carefully edited and amply illustrated, this presentation will be of much interest to geologists concerned with Latin America. The papers were written by some of the Western Hemisphere's leading geologists and are sure to merit an enduring place in the literature.

OHIO FOSSILS. By Aurele La Rocque and Mildred Marple. Published by the Division of Geological Survey, State of Ohio. 152 pp., 97 cents; from: Ohio Division of Geological Survey, Room 106, Orton Hall, Ohio State University, Columbus 10.

This book is an introduction to the paleontology of Ohio. Written in nontechnical terms, it covers the fundamentals of fossil classification and shows more than 400 drawings of various types. The first three chapters give the background of the subject, and the next seven describe the commoner fossils found in each geological system in the state. All references in the text are given in a reference section which consists of a guide to the literature of Ohio paleontology.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, Petroleum Refinery Consultant, Tulsa.
The index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

	Index (1946 = 100)					
	1948	1950	1952	1953	1954	August 1955
Pumps, compressors, etc.	127.0	138.2	155.6	162.5	166.5	170.9
Electrical machinery	127.6	134.9	152.4	156.4	160.0	161.7
Internal-combustion engines	116.9	126.0	146.5	148.1	150.5	153.2
Instruments	120.0	127.8	146.2	151.8	154.6	162.9
Heat exchangers	130.0	140.0	165.8	174.9	171.7	156.2
Miscellaneous equipment average	*122.1	*126.2	153.3	158.8	160.7	161.0
Materials component	139.3	149.5	164.3	172.4	174.6	179.2
Labor component	128.0	144.0	163.1	174.2	183.3	191.6
Nelson construction index	132.5	146.2	163.6	173.5	179.8	186.6

*Used in computing the Nelson Index until April 1952. These are slightly different from the average of the Miscellaneous Equipment Items shown above.

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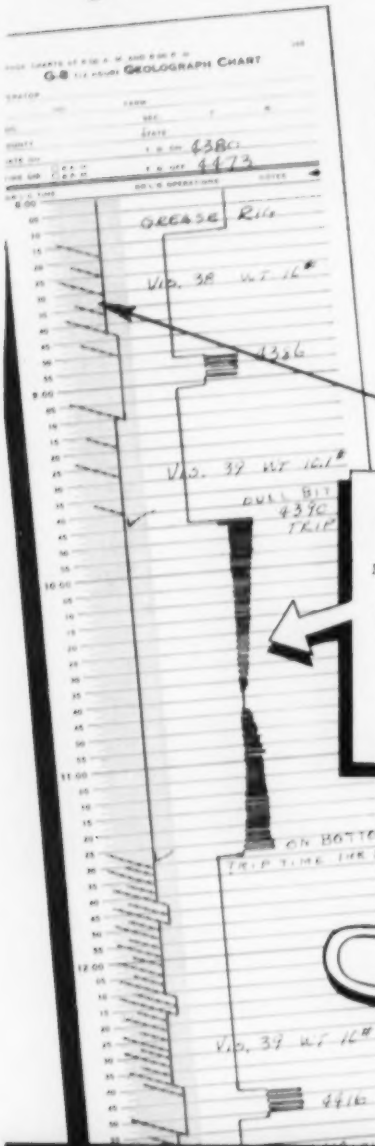

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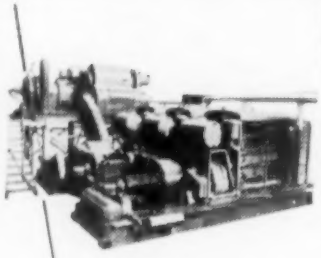

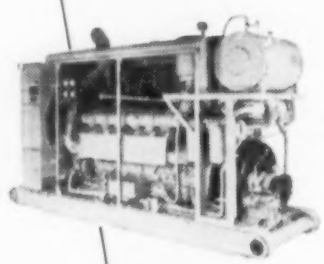

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by **W. L. Nelson**
Technical Editor

COST-imating

3. Storage Tanks Are Major Refining Cost

THE amount of storage required for refinery operation is enormous. Crude oil must be stored to insure continuous operation, intermediate products are collected in tanks adjacent to the operating units, and finished-product storage is required for serving the market or for the accumulation of tenders for pipeline transportation. The holdup of oil in storage ranges from a minimum of about 35 days, and one older plant maintains a storage of almost 9 months (mainly crude oil). Average storage capacity appears to be 60-70 bbl. per daily barrel of throughput, and the average cost of this storage (if new) is $110-$130 per daily barrel of capacity (1955).

The seasonal variations in the price of fuel oils and of gasoline is usually large enough to justify the installation of storage tanks to hold oil from one season to the other, and this accounts for much of the refiner's storage capacity.

Wide variations in cost (see figure) occur mainly because of the thickness of metal employed. This variation is avoided to a large extent if costs on a pound basis are used (see Cost-imating, issue of November 7, 1955). The costs shown on this page are installed costs but without painting or foundations. The costs of floating-roof tanks was obtained by ratio to the cost of cone-roof tanks. Erection of tanks in the field constitutes 25 to 45 per cent of the cost. Domestic fuel-oil tanks when installed underground cost about 20 per cent additional.

Guniting for corrosion protection ranges in cost (1946) as follows:

	Cents per sq. ft.
Roof and structural members	40-51
Walls or shell	36-47
Bottom	32-44

COST INDEXES (1946 = 100)[1,2]

	Steel plate	Iron and steel	Wages, structural ironworkers	Wages, refinery labor	Nelson index[3]
1946	100.0	100.0	*100.0	100.0	100.0
1947	117.5	121.0	113.0	113.0	117.0
1948	140.0	141.1	132.0	128.0	132.5
1949	134.8	150.2	133.0	137.0	139.7
1950	136.0	152.9	139.0	144.0	146.2
1951	156.1	166.7	149.0	152.0	157.2
1952	153.4	168.5	151.0	163.0	163.6
1953	150.3	177.5	159.0	174.0	173.5
1954	147.3	179.6	176.0	183.0	179.8
1955 est.	154.0	197.0	183.0	190.0	184.5

*Index based on New York City wages (E. N. Record, September 1955). Wages in New York were $2.25 per hour during 1946. Estimate for general refinery work (1946) as $1.80 per hour.

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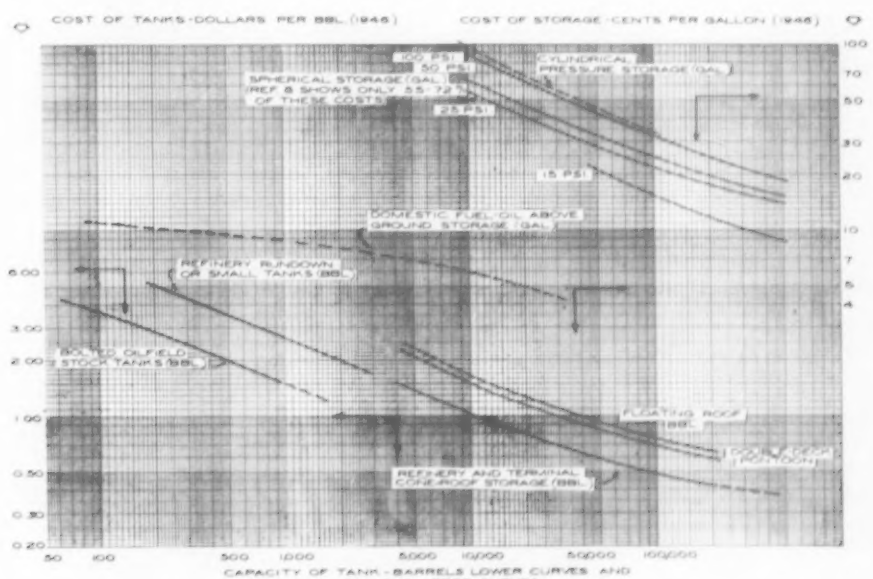
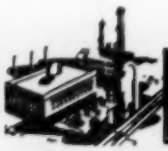




THE FOREMAN'S PAGE

Refining • Petrochem • Natural Gasoline

JOB IMPROVEMENT FOR THE PROCESS FOREMAN—33

Suction Lift and Fluid Viscosity in Rotary Pumps

SUCTION lift occurs where the total suction head at the pump inlet is below atmospheric pressure. It is normally the result of a static lift and pipe friction.

Although rotary pumps are capable of producing a high vacuum, it is not this vacuum that forces the fluid to flow. It is atmospheric pressure that forces the fluid into the pump. Since atmospheric pressure at sea level corresponds to 14.7 psia. (or 30 in. Hg), this is the maximum pressure available for moving the fluid and suction lift cannot exceed these figures.

Actually, it must be somewhat less, since there are always pump inlet losses.

Q. What suction lifts are used with rotary pumps?

A. The majority of present-day rotary pumps with suction lifts of about 5 to 15 in. Hg. Lifts corresponding to 24 to 25 in. Hg are not uncommon. There are numerous installations operating continuously and satisfactorily where the absolute suction pressure is within ½ in. of the barometer. In the latter case, however, the pumps are usually taking the fluid from tanks under vacuum, and no entrained or dissolved air or gases are present.

Great care must be taken in selecting pumps for these applications since the inlet losses can very easily exceed the net suction head available for moving the fluid into the pumping elements.

When a pump is to handle extremely viscous fluids — such as grease, chilled shortening, cellulose mixtures and similar materials—it is wise to review the basic considerations. The largest possible size suction piping should be used, all necessary fittings and valves should be eliminated, and the pump should be placed as near as possible to the source of supply. It may also be necessary to supply the fluid to the pump under some pressure provided by elevation, air, or mechanical means, such as a screw conveyor.

Viscosity and speed are closely related. It is impossible to consider the one without the other. Although rotative speed is the ultimate outcome, the basic speed which the manufacturer must consider is the velocity of the fluid going through the pump.

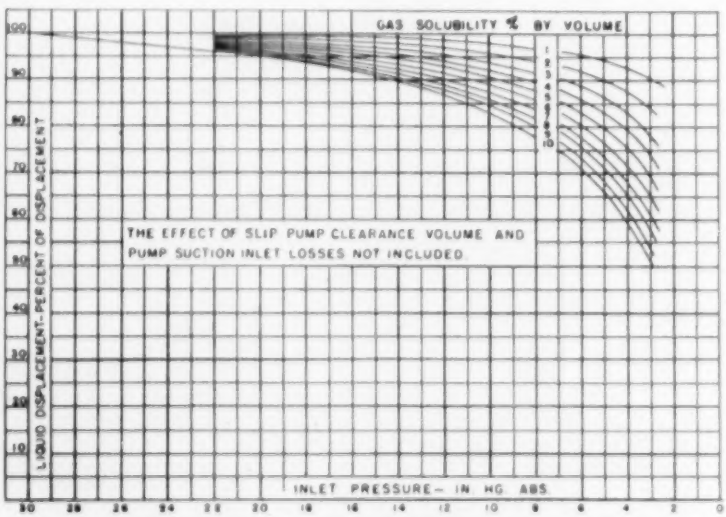
Q. How much does fluid viscosity affect the rotative speed of various pumps?

A. Certain types of rotary pumps such as gear and vane pumps carry the fluid around the periphery of the pumping elements. As a result the velocity of the fluid through the pump can become quite high unless relatively low rotative speeds are used. In screw-type pumps, because the flow is axial, lower fluid speeds are obtained. This permits higher rotative speeds.

In handling very light fluids, say 100 to 500 S.U.s., gear or vane-type pumps rarely exceed a rotative speed of 1,200 r.p.m. except in the case of very small units or special designs for a particular use as in aircraft applications.

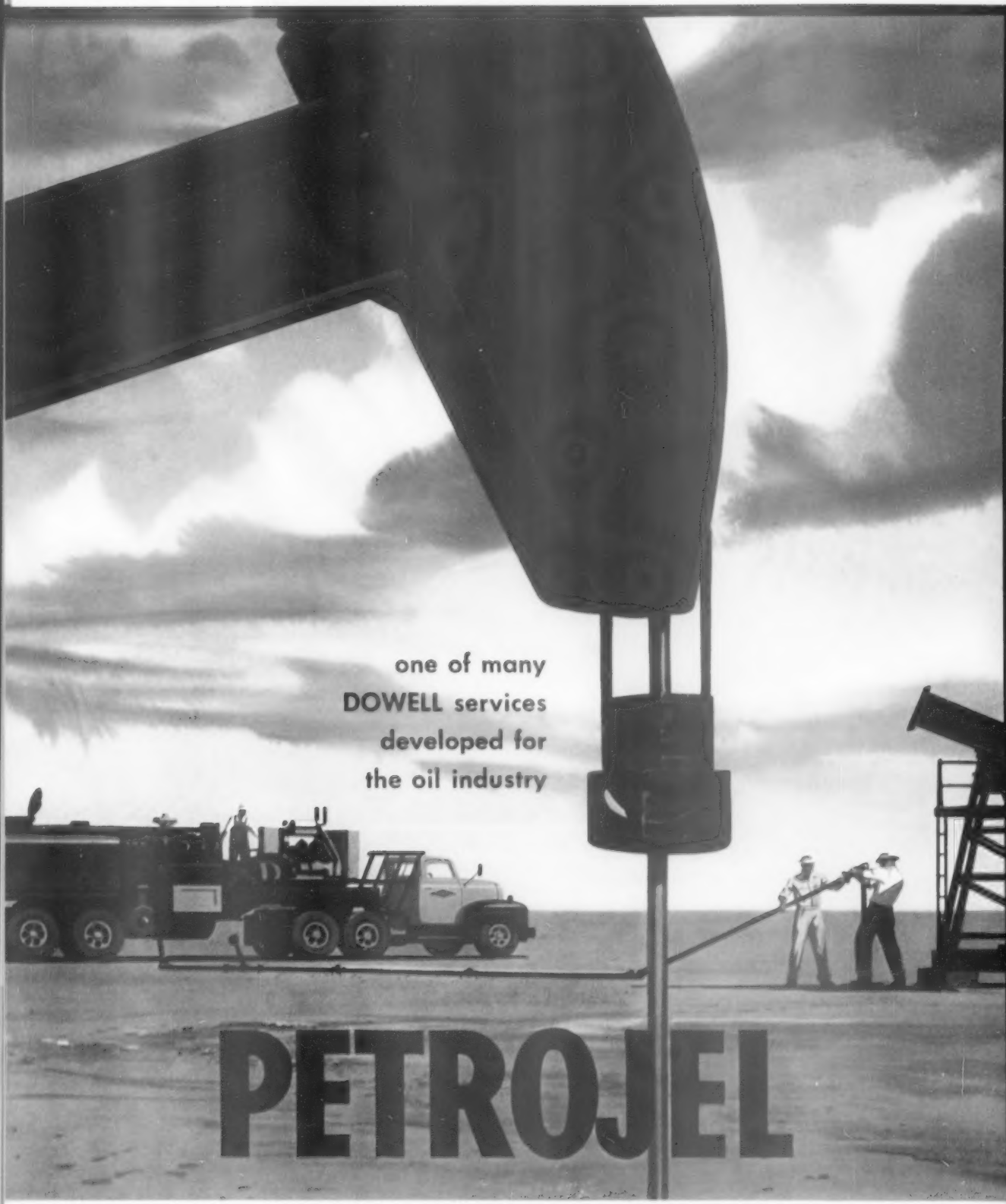
But screw pumps, where timing gears are not required, commonly operate without difficulty at speeds up to 5,000 r.p.m. There are even instances where special designs are operating at speeds of about 24,000 r.p.m. taking oil under lift from a sump tank located below the pump.

Although rotative speeds are relative and dependent on the pump type, they usually should be reduced when handling fluids of high viscosity. This is due not only to the difficulty of filling the pumping elements, but also to the mechanical losses which result from the shearing action of these parts on the fluid handled. The reduction of these losses is frequently of more importance than relatively high speeds, even though the latter might be possible due to positive inlet conditions.



THIS is the effect of dissolved gas only on liquid displacement of rotary pumps.

From material prepared by W. J. Mongon, De Laval Steam Turbine Co., Trenton 2, N. J.



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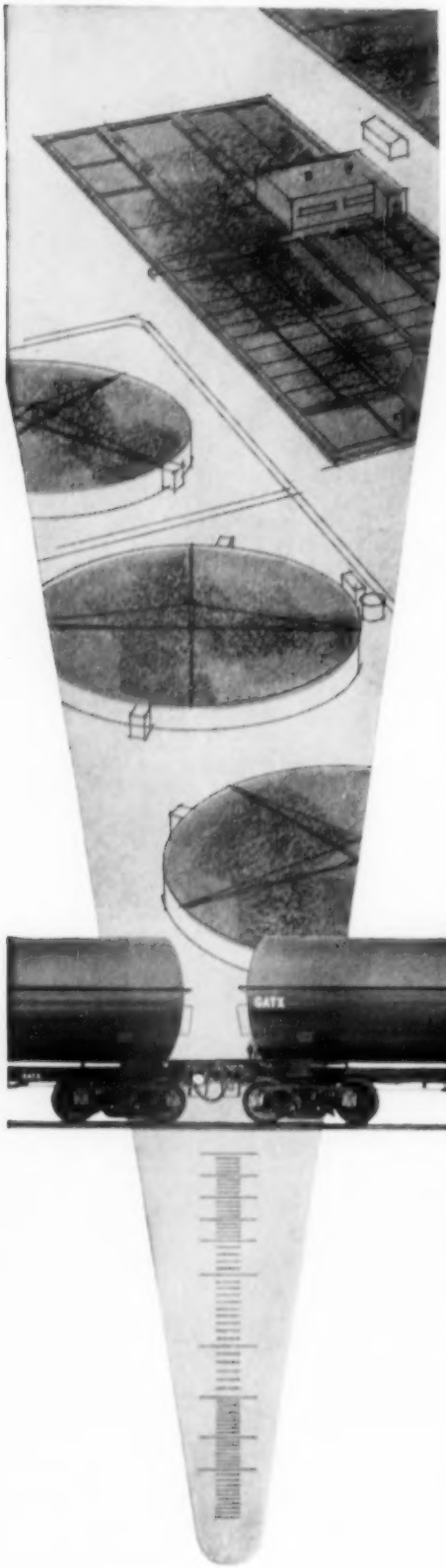

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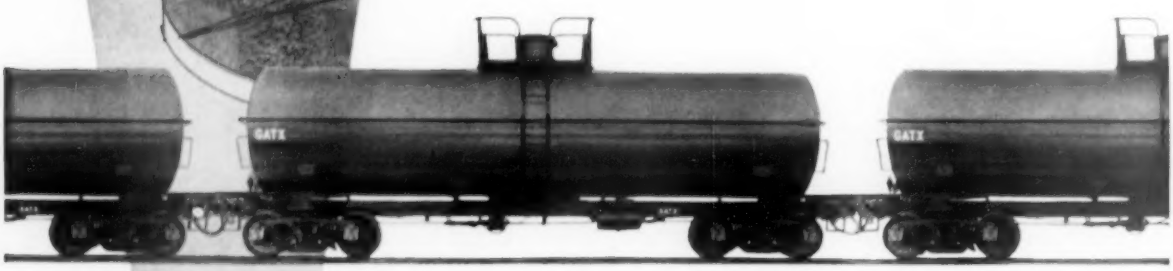

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CALCULATION OF SURFACE TENSION—3

Calculating Parachor Values

THE main effect of pressure is to change the composition and density of the liquid and vapor. A combination of a modified Eotvos equation and the Van der Waals equation relates these effects:[12]

$$\gamma^{1/4} = P\frac{d_L - d_v}{M}$$

Where:

d_L = density of liquid at given temperature, pressure, and composition, grams per milliliter.

d_v = density of vapor at given temperature, pressure, and composition, grams per milliliter.

M = molecular weight.

P = the parachor of the compound.

The parachor is a constant characteristic of a pure compound. It may be thought of as a comparative or relative volume. It is an additive property and is very useful in calculating the surface tension of mixtures.

The detailed calculation procedure will be given later. Parachor values for many compounds are reported in References 5, 12, 16, 17, 20, 21, 22, and 23*. Values for hydrocarbons are given in Table 3 and Fig. 2.

Parachor values may be determined for mixtures of pure compounds such as crude oil, but it should be noted that the parachor for a complex mixture will change with the vaporization of a part of the mixture while the parachor for a compound is constant. The parachor value is approximately 1.2 times the viscosity - constitutional constant of Sauders.[24,25]

*All references mentioned here were listed in the first installment, published November 21, p. 259

TABLE 3—PARACHOR VALUES

Compound	M.W.	Gal./mole
C_1	16	6.416
C_2	30	9.112
C_3	44	10.423
i-C_4	58	12.392
n-C_4	58	11.959
i-C_5	72	13.875
n-C_5	72	13.743
C_6	86	15.582
C_7	100	17.487
C_8	114	19.392
C_9	128	21.339
C_{10}	142	23.286
C_{11}		
C_{12}		
$C_2=$	28	
Acetylene	26	
$C_3=$	42	
H_2	2	
N_2	28	6.884
CO_2	44	6.860

Compound	T_c, °R.	P_c, psia.	Parachor
C_1	343.5	673	77.0
C_2	550.1	708	108.0
C_3	662.2	617	150.3
i-C_4	733.2	544	181.5
n-C_4	765.6	551	189.9
i-C_5	830.0	482	225.0
n-C_5	847.0	485	231.5
C_6	914.6	434	271.0
C_7	972.6	397	312.5
C_8	1,024.8	361	351.5
C_9	1,072.0	337	391.1
C_{10}	1,115.0	312	431.3
C_{11}			471.0
C_{12}			510.5
$C_2=$	509.5	749	100.1
Acetylene	556.8	911	88.6
$C_3=$	656.8	668	139.9
H_2	60.0	188	*34.0
N_2	692.8	492	60 in C_4— 41 in C_5+
CO_2	548.0	1,073	(?)

*Approximate

Authors are with natural gas department, Magnolia Petroleum Co., Dallas.

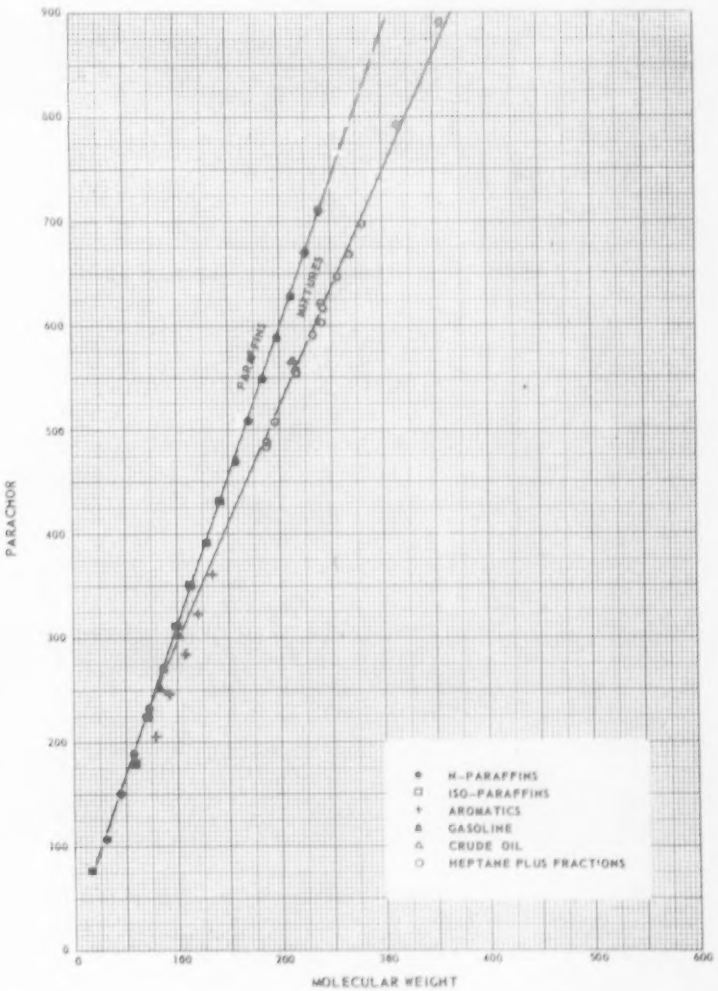

Fig. 2.

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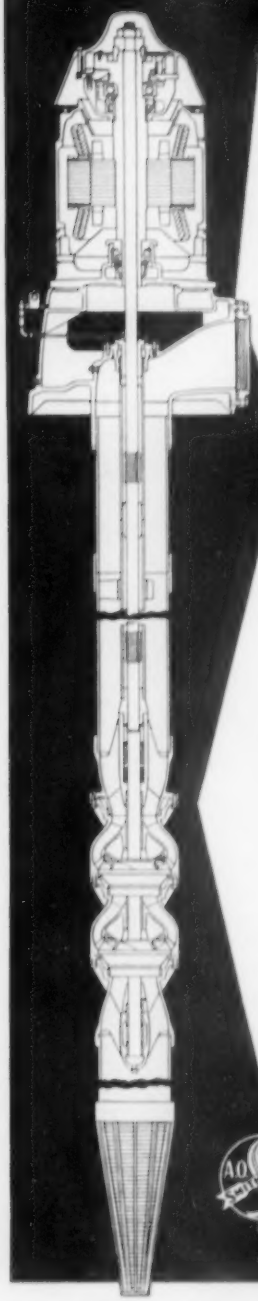

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New Correlation for Flashed Products Composition—4

by N. R. Vaswani

METHOD of handling the data to obtain this correlation was outlined in Installment 3 of this series (*The Oil and Gas Journal, October 31, 1955*). There were apparently some errors in the distillation data used. For example, note the case of stock 22 (Table 1 in Installment 2, *The Oil and Gas Journal, October 17, 1955*).

An inspection of the T.B.P. distillations on the runs of this stock showed some discrepancies. For instance, the distillation of the bottoms from 0.4 per cent flashed, and of the vapor from 99.6 per cent flashed, did not check with the distillation of the feed stock as would be expected. In many cases, the distillation temperatures of the vapor were higher than those for the feed at the corresponding distillation points, while in other cases the distillation temperatures of the bottoms were lower than those of the feed.

The data for 37.0 per cent and 82.1 per cent flashed appeared to be correct. With these as a basis, a set of points was established by means of a material balance at different temperatures. It was found that the 30, 50, 70 and 90 per cent points thus calculated checked closely with the given data for the feed. Therefore the given feed distillation was assumed to be correct.

Next the distillation for 0.4 per cent bottoms was calculated, using data for feed and 0.4 per cent vapor as a basis. It was found in this case that the distillation curve so obtained did not differ appreciably from that of the feed. This was also true for the 99.6 per cent vapor.

Also, it was noted that the I.B.P. for both the 0.4 per cent and 37.0 per cent flashed bottoms as listed in the data is apparently a misprint and should read 460° and 470° F. rather than 260° and 270° F.

In the next and last installment, predicted T.B.P.'s for two stocks will be compared with the experimental T.B.P.'s.

This correlation was prepared by the author while he was fulfilling requirements for an M.S. degree in petroleum refinery engineering at the University of Tulsa. Present address is 19, St James Court, Marine Drive, Bombay, India.

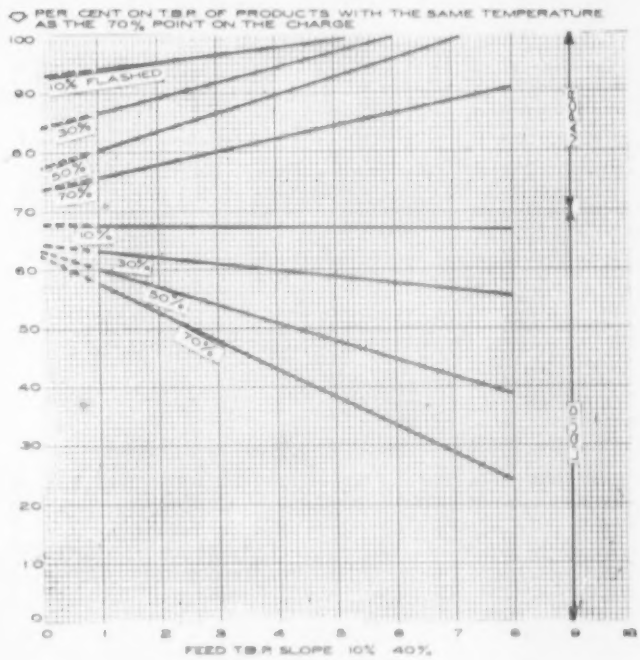

Fig. 7.

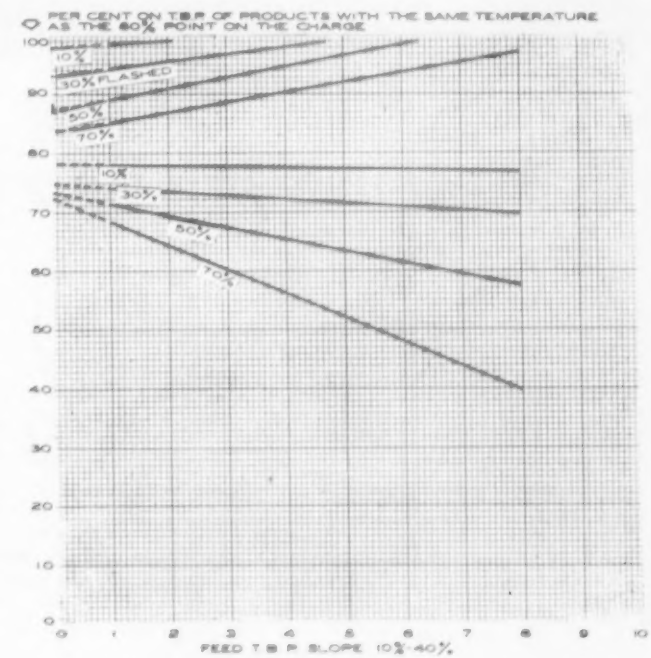

Fig. 8.

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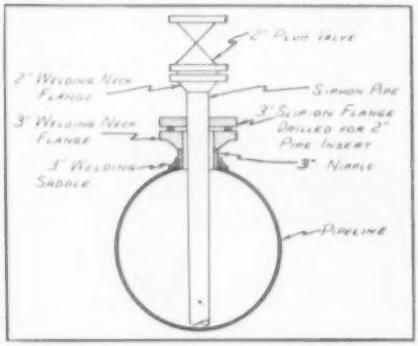

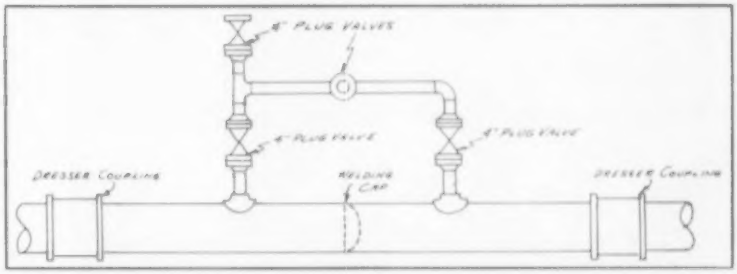

PUMP JOINT (above), placed near center of test section, allows filling in both directions. Fig. 2.

SIPHON BLOWOFF (left) has removable riser for scraper running. Fig. 1.

Here's how Oklahoma Natural conducts

Hydrostatic testing of old pipelines

by J. D. Kelley

Portable pumping equipment and a standard operating procedure makes the job easier and faster.

OKLAHOMA NATURAL GAS CO. operates several transmission lines which have been in service for periods of 25 years or longer. During the last 10 years when the majority of these old lines were water tested to qualify for high-pressure operations conditions, it was our practice to establish high operating pressures at 80 per cent of the applied hydrostatic test pressure. We now subscribe to requirements of American Standards Association B31.-1.8-1955.

Equipment used for water tests has now evolved into two complete sets of pumps consisting of three pumps in each group. One group is located in Tulsa for use by operating personnel in the eastern half of the state. The other group is in Oklahoma City for use in the western half of the state.

The group of pumps located at Tulsa consists in part of one 4-in. low-pressure centrifugal pump and one 3-in. centrifugal high-pressure pump. Each pump is mounted on standard automobile tires and axle and clevis-type trailer hitch, and is equipped with knock-on-type unions for coupling up.

A 25-ft. flexible hose equipped with foot valve and strainer is used with each pump.

The other pump in the Tulsa group is an 8 by 5-in. reciprocating pump mounted on a four-wheel trailer. The pump has interchangeable 5, 3½, and 2½-in. pistons and liners. This pump delivers 86½ g.p.m. with 5-in. liners at 600 psig.; 42 g.p.m. with 3½-in. liners at 900 psig.; and 21½ g.p.m. with 2½-in. liners at 1,700 psig.

Test Procedure

The usual setup for using these pumps is to use the 3-in. pump to supply water from a pond or water line to the large pump. Sometimes it is necessary to connect the 4-in. pump in series with the 3-in. to supply necessary water suction to the big pump.

Before testing an old line, we closely investigate construction and maintenance records of the particular line. These records reveal location of material in the line which is not qualified for high-pressure service. Such equipment includes old-style drips, low-pressure-rated valve junctions, temporary repairs, and sections of line where past leak history requires pipe replacement.

Work required as shown by these records is performed while the line is down as an immediate preliminary to testing. During this preliminary work, main-line customers are turned off, meters removed, siphon blowoffs (Fig. 1) installed for filling and draining of line, and pump joints (Fig. 2) and plug joints are installed.

A plug joint is installed at each end of the test section and a pump joint is installed at or adjacent to water supply near the middle of the test section. Siphon blowoffs are placed at most low points in the line for use in cleaning line and draining for repair. On occasions, considerable lengths of temporary gas-service lines and water-supply lines must be laid to accomplish the test.

In starting the line fill, the medium-pressure centrifugal pump is used alone up to its top pumping pressure. But prior to completely filling the line, the big pump is placed in service. The line is usually patrolled by line walkers who close air vents (siphon blowoffs, and meter risers) as water filling progresses.

Line repairs . . . As the line pressure begins to reach the higher ends of the test section, crews are placed at all highway crossings and section-line roads as a precaution in event of blowouts to halt traffic and prevent major damage. When blowouts occur, pumping is immediately stopped and the line is walked to locate the leak. Repairs are made during the same day so that another test may be placed on the line during the night to expedite completion of a satisfactory test. This usually allows all daylight hours to be devoted to line repairs or walking the line to locate leaks.

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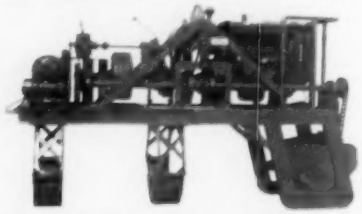

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Pipeline Patrol

When seep leaks occur during testing, it is necessary to keep the pumps operating long enough so a large enough volume of water will be forced through the leak to make leak location possible by walking the line. This particular type of leak is one wherein removal of water so that repairs may be accomplished is difficult. It is sometimes necessary to knock a hole in the line so that suction hose from a portable water pump may be inserted in the line to remove the water. Each blowout or leak nearly always requires the use of portable pumps to evacuate the ditch and use of bellholes to make repairs.

Failures of the line during pumpups are very discouraging in that they quite often occur erratically with respect to failure pressure. The first failure, for example, may be at 500 psig, and the second at 200 psig. When test pressure is reached, it is left on the line for a period of 1 or 2 hours and the pressure during this period recorded on a chart and checked with the deadweight tester. If no pressure drop occurs during this time, the test has been completed satisfactorily.

Our pump joints in the line are so constructed (see Fig. 2) that when satisfactory results are achieved on a portion of the line, a bypass is opened across the pump joint. Water is then flowed from the tested section to the new section to be tested. This shortens test time and conserves water with reduced pump use.

Line drying . . . When cleaning the line in the past it was our custom to remove plug joints, install blowoff joints, and use available gas pressure to blow the line. Considerable gas was lost by this method and the line was not dried very satisfactorily. So we now introduce squeegees to clean lines prior to return to service and enough squeegee runs are made so that the line is judged clean.

With our old method of cleaning, siphon blowoffs were ideal for removing the greater part of the water prior to blowing. To clean with squeegees we have changed our siphon blowoff design so that the part of the blowoff protruding into the line is now removable.

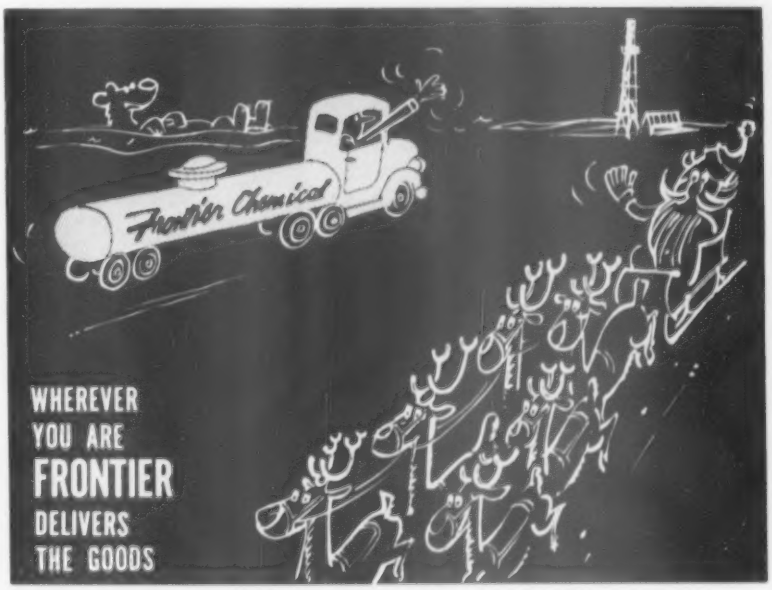
Another change in our testing procedure is our policy of testing all highway, railroad, and creek crossings separately from the remainder of the line. This change was due primarily to the fact that a better grade of material was used at these locations and dictates of safety required higher test pressures on these portions of the line. In addition on our overhead crossings a stiff leg is installed under the crossing prior to water loading the line, even though these crossings are designed to accommodate this additional weight.

Water testing new construction is considerably simpler than procedures required on old lines. Construction is usually finaled in such a way that one pumpup is all that is required and preliminary work consists almost entirely of connecting pumps between the line and the water supply. In distribution plants we have found it a desirable technique to omit valve installations from the line prior to water test. This makes pigging procedures simpler and removes the problem of dividing the

THE AUTHOR

J. D. Kelley is a graduate of the U. S. Naval Academy. He received a B.S. degree in engineering in 1945, and is also a veteran of World War II and Korea.

He joined Oklahoma Natural Gas Co. in 1947 as an engineer trainee. He has served as construction inspector, engineer-dispatcher, assistant to the district superintendent, and assistant district superintendent —the position he holds today.



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GENERAL OFFICES
WICHITA, KANSAS

WICHITA, KANSAS / DENVER CITY, TEXAS / DUMAS, TEXAS / MIDLAND, TEXAS

Pipeline Patrol

line into test sections. However, arrangements must be made to test valves hydrostatically prior to installation in the line.

Fortunately, our experience with air testing of new construction has not resulted in small leaks on the line, thus eliminating the difficulties of finding such small leaks. With this type of test we apply the required test pressure on the line with compressors, allow the line to set under pressure overnight with a recording gage on the line, and test for leaks the next morning.

We use a bubble-type leak detector to determine if the line is tight. We assume that with this device there is less probability that temperature changes in the line will interfere with the test.

Conclusion

We now test all new construction by some method. Hydrostatic water testing is the technique we use on nearly all new transmission-line construction. It is also used on many new main-distribution lines, although air tests are becoming more common in the distribution systems.

Water testing of old main lines has become very difficult during recent years because of the prolonged drought. This is partially responsible for our general policy shift toward air testing.

Windshield for welders!

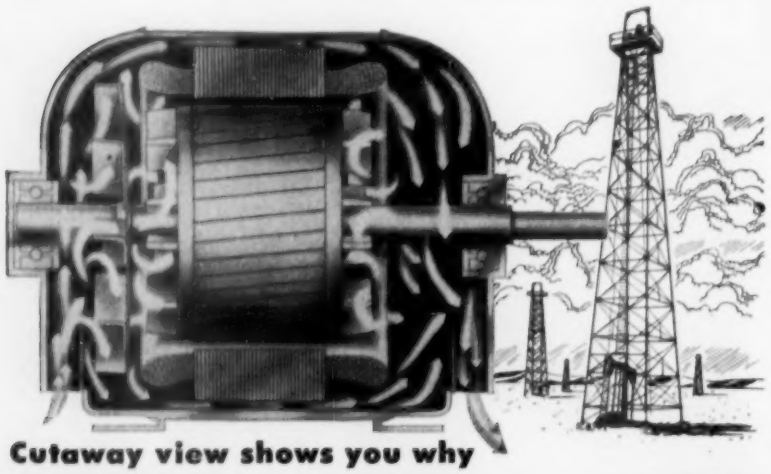
STRONG winds on the high plains in southern Wyoming caused welders to resort to these plywood windshields. These men are working on the Colorado Interstate Gas Co.'s 22-in. line from Laramie to Denver being laid by Houston Contracting Co. Without the shields, the high winds made holding an arc difficult.

These shields are cut to fit the pipe from ⅜-in. plywood. Welders report they work very well. All firing line welders were using them on the job. Stringing and hot-pass welding was done without them because speed of that operation would be retarded if helpers had to bother with the clumsy shields.

Chains increase traction

SHORT lengths of chain bolted onto this dragline's tracks give it the needed traction for working in slick mud. Note that the chains are bolted on rather than being welded. This gives less chain breakage and allows easy removal when necessary.

This dragline was working on the H. B. Zachary Co. spread when that firm was laying part of the Texas Eastern Transmission Co. 30-in. line from Beaumont to Kosciusco, Miss.



Cutaway view shows you why

R&M Oil Country Motors run COOL!

"Clean-sweep" ventilation insures longer motor life

...and greater stamina for overloads

Cool running—hour after hour at full capacity—is one of the big reasons why so many oil field men swear by R & M "All-Weather" Motors. These motors are designed to permit ample circulation of high velocity air—to carry off motor heat, as well as heat developed by exposure to the hot sun. And, openings are drip-proof, rain-proof; screened to keep rodents out. Special treatment inside and out resists rust and corrosion. Heavy duty bearings are sealed to retain lubricant. In short, here are motors that will give you years of faithful service.

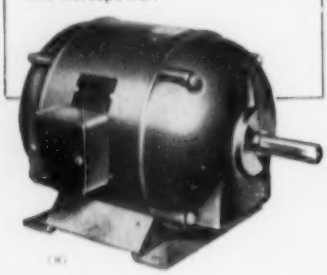
There's an R&M "All-Weather" motor that's built for YOUR job!

Triple-Rated—for changing power needs. Slight additional cost is quickly written off by power savings. You buy power only for the connected horsepower you need. As requirements change, you change the horsepower—*without changing motors.*

High Slip—ideal for the reciprocating load requirements of oil pumping.

High Torque—to meet heavy starting problems.

Standard Integrals—from 1 to 200 horsepower.



It will pay you to get the whole story!

Write today for name of your nearest R & M distributor. He can prove—in dollars and cents—that all these "extras" in R & M motors are furnished *at a standard motor price!* Be sure to ask for R & M bulletin on oil field motors; it's packed with good, usable information.

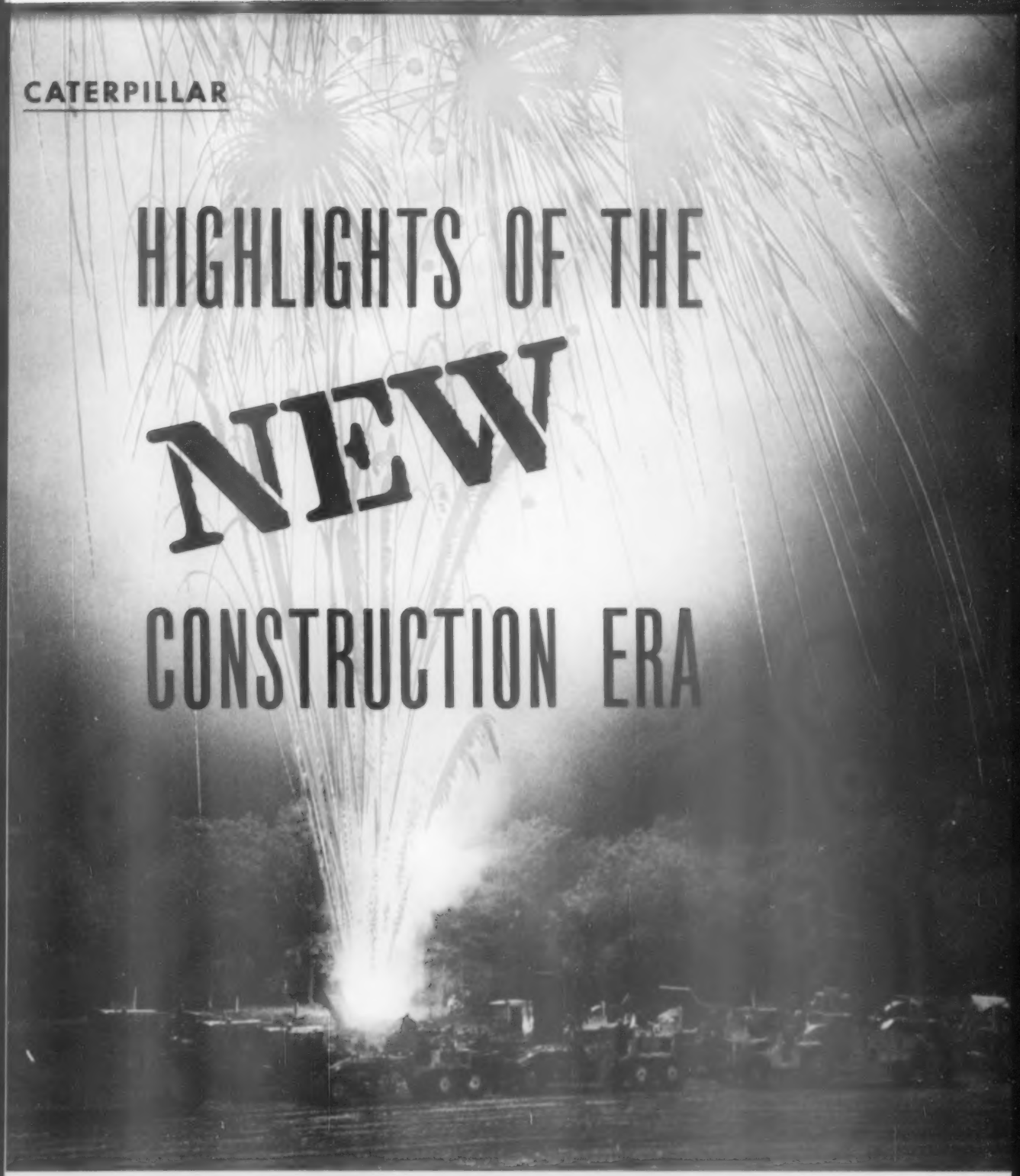
R&M "All-Weather" Oil Country MOTORS

ROBBINS & MYERS, INC.
Springfield 103, Ohio • Brantford, Ontario

"All-Weather" is the trademark of Robbins & Myers, Inc.

CATERPILLAR

HIGHLIGHTS OF THE NEW CONSTRUCTION ERA



Never before in history has the equipment industry faced such a tremendous challenge as today. We are entering what might well be called the "construction era." Right now construction is the greatest single factor in our industrial economy, employing 12% of our total labor force. And construction can never move forward by itself. Its progress is dependent upon increased production in mines and forests, cement mills and steel plants. Caterpillar Tractor Co. is matching these new opportunities with an array of new products that will increase production, cut maintenance costs, work longer and more profitably than any other equipment on the market. These Caterpillar-built products are the result of continuing research in the laboratory and in the field. They are forceful evidence of Caterpillar Leadership in Action. See them on the following pages.

NEW in track-type tractors!

The new D9

This new giant is a bear for work. Choice of torque converter or exclusive oil clutch drive. First track-type tractor with Turbocharger. Completely new 286 HP engine. "Live-shaft" drive for rear-mounted equipment. Many other important features.

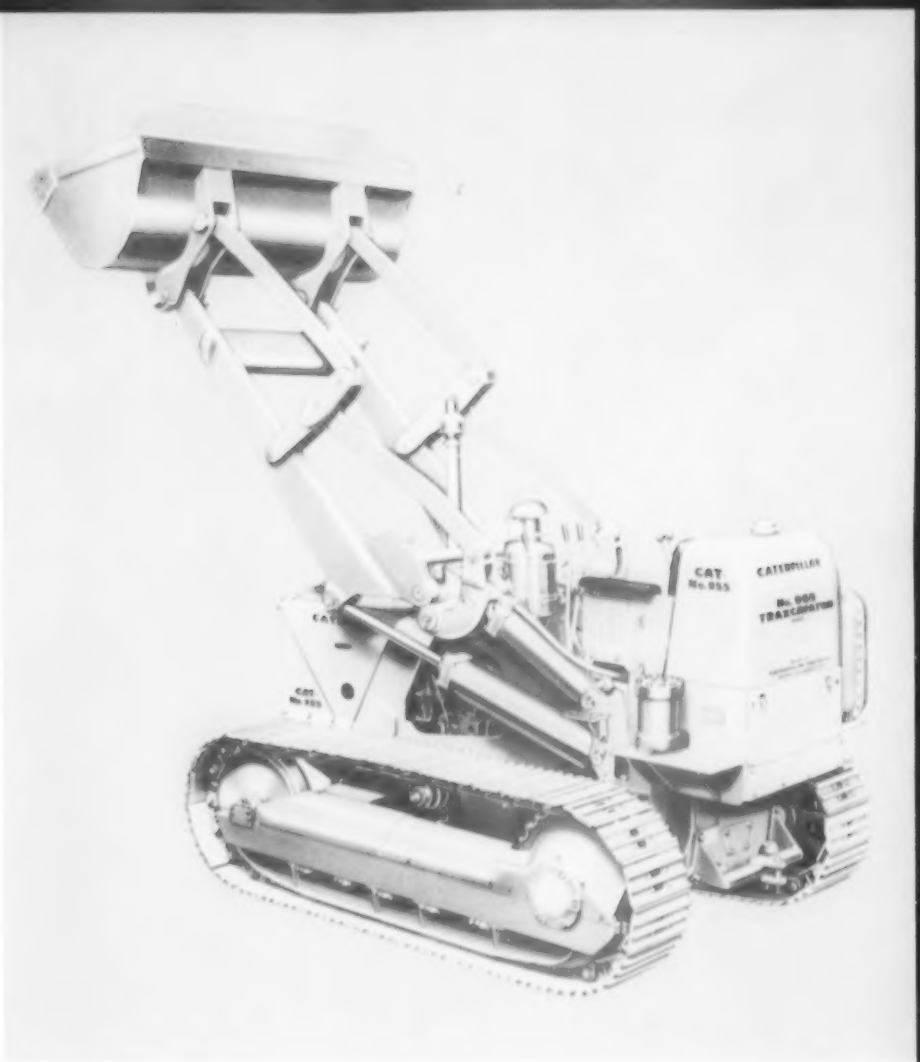
The new D8

With torque converter (Series D) or direct drive (Series E). Completely new 191 HP engine. "Live-shaft" drive for rear-mounted equipment independent of flywheel clutch. New easy controls. Many other improvements. Shown with new Cat No. 463 LOWBOWL Scraper.

The new D7 (Series C)

New 128 HP engine. Drawbar pull 28,700 lb. maximum. Exclusive oil clutch. Finger-tip steering. New starting engine for easier operation. Track shoes hardened by "*water quench*" process (also on D8 and D9). Many other important advances.

LEADERSHIP IN ACTION



No. 955 — 1½-yard capacity

Balanced for bigger production at lower cost. Major features: 40-degree bucket tip-back at ground level, new oil-type clutch, convenient lift and dump levers, modern hydraulic system, high reach, "designed in" operator comfort, optional starting and versatile attachments.

NEW in Traxcavators!

No. 933 — 1-yard capacity

Like its bigger brother, *balanced* to outproduce ordinary tractor-shovels of equivalent capacity. Also backed by *one* manufacturer to provide you the advantages of single manufacturing responsibility and one service source. Major features—same as the No. 955!

LEADERSHIP IN ACTION

NEW in wheel-type tractors!

The new DW21 Tractor

(Series C.) New 300 HP Caterpillar Engine with Turbocharger. 10% more rimpull. New No. 470 LOWBOWL Scraper. 18 cubic yards struck, 25 cubic yards heaped capacity. New, wide-section 29.5-29 tires give big-footprint flotation and maximum traction. Many other new, thoroughly tested features.

The new DW15 Tractor

(Series C.) 186 HP valve-in-head Caterpillar Engine. Speeds up to 24 MPH (31.3 MPH with optional gears) pulling loaded wagon or scraper. Heavy-duty clutch has air booster. Air brakes. Wide range of speeds: 10 forward, 2 reverse.

The new DW20 Tractor

(Series E.) Shown with new No. 456 LOWBOWL Scraper. This great new team highballs up to 32.1 MPH for fast cycle times. Same 300 HP engine with Turbocharger and wide-section tires as DW21. LOWBOWL design loads more material in less time by using tractor and pusher power at maximum efficiency.

LEADERSHIP IN ACTION

NEW in pipelayers!

The new No. 583

Here, for the first time, is a pipelayer that is *all* pipelayer—not a tractor attachment. It's the most efficient, highest capacity pipelayer in history. Lifting capacity of 130,000 pounds and 21-inch clearance. Three-stage torque converter in main drive and new hydraulically actuated counterweights. Stability is unequalled. A heavy-duty constant-mesh pipelayer winch transmission drives directly from the engine. Many more important advances, all designed to produce more profits for pipeliners.

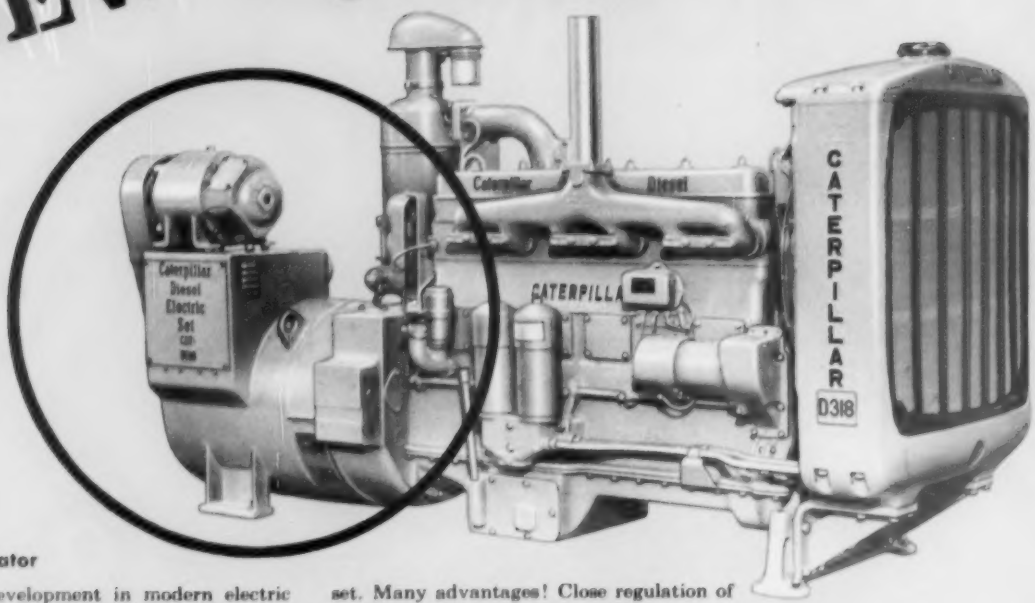
NEW in motor graders!

The new No. 12 with oil clutch

With the addition of the job-proven oil clutch, the big, versatile No. 12 Motor Grader gives you more economy and efficiency than ever. The new clutch increases work life since the constant oil bath lubrication reduces wear on all moving parts. There is less maintenance; 1500 hours without adjustment is not unusual and no external lubrication is needed. The new No. 12 is more efficient because the clutch is constantly cooled, eliminating clutch fade and slippage due to overheating.

LEADERSHIP IN ACTION

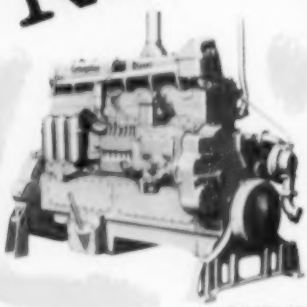
NEW in generators!



Cat Generator

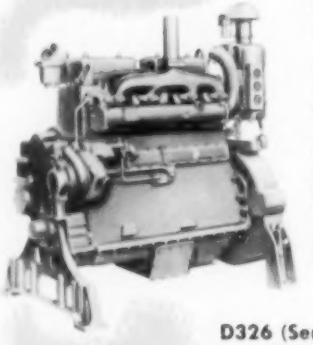
A major development in modern electric power. Brings to Caterpillar's new line of Diesel Electric Sets the efficiency of the externally-regulated set in a self-regulated set. Many advantages! Close regulation of voltage, simple control, excellent motor-starting ability, easy hook-up with other generators . . . 100% backed by Caterpillar.

NEW in diesel engines!



D342—210 HP maximum @ 1200 RPM

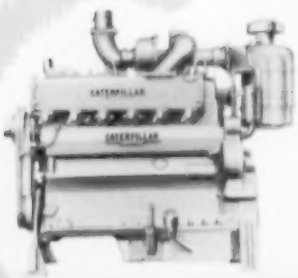
Incorporates the latest advances in modern, compact, heavy-duty diesel design. Offers better operation, less maintenance, higher horsepower. Choice of 3 starting systems—air, electric, gasoline. Like all Caterpillar Engines, burns wide range of fuels without fouling.



D339—140 HP maximum @ 1200 RPM

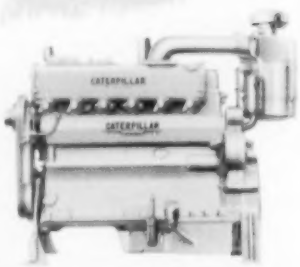
Combines new compactness with greater efficiency, economy and higher horsepower. A modern, heavy-duty 4-cylinder unit with new smoothness of operation. Choice of 3 starting systems. Many other advantages, including full-flow filtering system.

D337 (Series F) with Turbocharger 310 HP maximum @ 2000 RPM



New Turbocharger utilizes exhaust heat to drive supercharger, delivers air in proportion to engine's need. New hydraulic valve lifters practically eliminate adjustment, provide quiet operation. Greater displacement for more power. Choice of 3 starting systems. Available as Electric Sets and Industrial Engines with complete line of attachments.

D326 (Series F)—200 HP maximum @ 2000 RPM

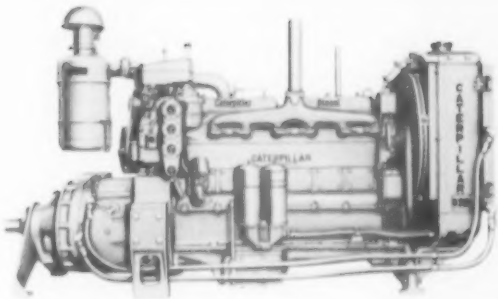


Like other new, heavy-duty Cat Diesels, offers you more for your money than any engine in its power range. Many major features, including hydraulic valve lifters and full-flow filtering. Greater displacement for more power. Choice of 3 starting systems. Available as Electric Sets and Industrial Engines with complete line of attachments.

LEADERSHIP IN ACTION

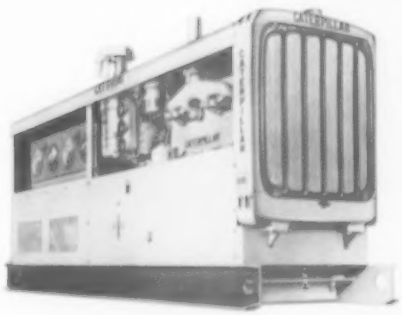
NEW in torque converters!

Caterpillar now offers a wide choice of torque converter power units in standard packages. Torque output is automatically matched to load for smooth load starts or control of load without use of clutch. Overloads can't kill engine. Your Caterpillar Dealer can supply these units. He also has full facilities and parts for service.



NEW in welders!

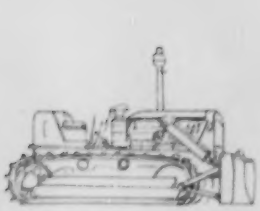
The new Caterpillar Twin Arc-Welder provides one engine, one base, and TWO 300-ampere welding generators. Four-cycle Cat Diesel picks up load instantly without missing or injector trouble. Compact design cuts transport and maintenance cost. Operators can weld at different voltages at same time. Single (3 KW) exciter cuts weight and size, provides ample excitation plus plenty of 115-V. DC for auxiliary tools.



NEW in portable electric sets!

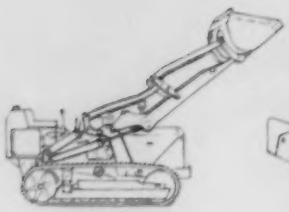
Cat Portable Electric Sets are now available in nine models, 30 to 315 KW, and in all usual voltages, 50 to 60 cycle. They're complete units with cooling system, fuel tank and switchgear, mounted on skids, semi-trailer or full trailer. Easy to hook up and operate, ready to work anywhere.

LEADERSHIP IN ACTION

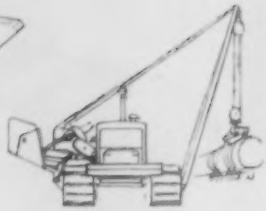


TRACK-TYPE TRACTORS

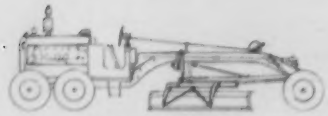
WHEEL-TYPE TRACTORS



TRAXCAVATORS



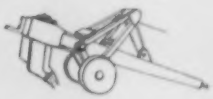
PIPELAYERS



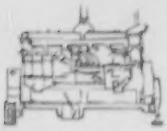
MOTOR GRADERS

SCRAPERS

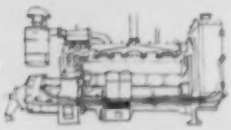
BULLDOZERS



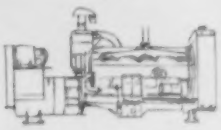
RIPPERS



INDUSTRIAL ENGINES

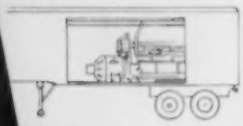


TORQUE CONVERTERS

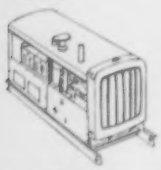


GENERATORS

FOR YOU CATERPILLAR LEADERSHIP PROVIDES THE MOST COMPLETE LINE IN THE INDUSTRY



PORTABLE ELECTRIC SETS



WELDERS

Year after year you have seen the results of Caterpillar leadership. It is always in action. It never stands still. The full resources of Caterpillar research, both in the laboratory and right in the field with you, are constantly devoted to improving products and developing new ones. This means that Caterpillar is your partner in progress, bringing you better and better products, greater opportunities for profitable work. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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LEADERSHIP IN ACTION

PRINTED IN U. S. A.

Among the

Drilling Contractors

Contractor Group Names Year's Committee Heads

Directors of the American Association of Oilwell Drilling Contractors have selected chairmen and vice chairmen for the association's 12 standing national committees to serve for the ensuing year. The appointments, announced by E. Dale Mount, president, and Brad Mills, executive president, of Dallas, follow, listing committees, and, in order, their respective chairmen and vice chairmen.

Accounting: C. H. Todd, R. W. Rine Drilling Co., Wichita, Kans.; Gerald N. Eason, Fain-Porter Drilling Co., Oklahoma City, and F. E. Godfrey, Big Chief Drilling Co., Oklahoma City.

Cable tool: D. B. Ferguson, Ferguson Drilling Co., Oklahoma City; Ferd J. Spang, Spang & Co., Butler, Pa., and Arthur Stout, McQueen & Stout, Midland, Tex.

Chapter activities: J. L. Stauss, Falcon Seaboard Drilling Co., Tulsa; Don Slape, Don Slape Drilling Co., Olney, Ill., and R. C. Sharp, Drilling & Exploration Co. of Delaware, Inc., Los Angeles.

Insurance: J. Mark Gardner, Delta Gulf Drilling Co., Dallas; R. F. McElhany, Loffland Brothers Co., Tulsa, and W. E. Armentrout, Southeastern Drilling Corp., Dallas.

Membership and dues: Lloyd R. Pickrell, Pickrell Drilling Co., Wichita; George H. Pappas, Paco Petroleum Corp., Mount Carmel, Ill., and B. F. Gilchrist, Gilchrist Drilling Co., Abilene, Tex.

Public relations: Frank G. McClintock, Zephyr Drilling Corp., Tulsa; John J. Moran, Moran Bros., Inc., Wichita Falls, Tex., and Guy B. White, Delta Drilling Co., Evansville, Ind.

Publications: George F. McQueen, McQueen & Stout, Fort Worth; John J. Moran, Moran Bros., Inc., Wichita Falls, and Guy B. White, Delta Drilling Co., Evansville, Ind.

Research and education: H. W. Davidson, Davidson Drilling Co., Midland; W. K. Powell, Beard Drilling Co., Duncan, Okla., and J. K. Kellogg, K. L. Kellogg & Sons, Compton, Calif.

Rotary drilling: William P. Clements, Jr., Southeastern Drilling Corp., Dallas; B. E. Groenewold, Exploration Drilling Co., Tulsa, and Earle C. Hellums, Gracey-Hellums Corp., Houston.

Safety: W. S. Fitzpatrick, Fitzpatrick Drilling Co., Corpus Christi, Tex.; H. L. Campbell, R. W. Rine Drilling Co., Wichita, and John S. Jackson, Rowan Drilling Co., Inc., Fort Worth.

Taxation: W. N. Blanton, Blanton Drilling Co., Houston; L. L. Tuck, Bueno Drilling Co., Denver, and R. S. Makin, Makin Drilling Co., Hobbs, N. M.

Transportation: Frank E. Frawley, Frank Frawley Drilling Co., Tulsa; R. L. Rose, Drilling Exploration Co. of Delaware, Inc., Los Angeles, and M. Q. Petersen, Petersen Drilling Co., Shreveport, La.

J. I. Roberts Drilling Co., Shreveport, has contracted for another Smackover test Skelly Oil Co. is undertaking in the area between East Haynesville and Colquit fields, in northern Claiborne Parish, northern Louisiana. Location, at 2 Owens, in 30-23n-6w, is ¾ mile southeast of Skelly's first test, abandoned early this year as dry at 11,262 ft. The new test, projected to 11,000 ft., is 1¾ miles east of East Haynesville, and 3 miles west of Colquit.

John F. Mitchell, Vivian, La., is contractor on a new Travis Peak wildcat test Harry and Robert Strief, of Dallas, are drilling at 1 Central Trading, in 34-22n-15w, 2½ miles southwest of Hosston, in Caddo Parish, northwestern Louisiana. Drilling is projected to 4,900 ft.

Wolfe Drilling Co. has taken a contract for another deep test Continental Oil Co. will drill at St. Martinsville, in St. Martin Parish, southern Louisiana. The new operation at 2 Bouevalt et al., in 80-10s-6e, on the north flank of the field.

Atlas Drilling Co. will drill a 12,500-ft. test for Tide Water Associated Oil Co. at an outpost location east of Church Point field, in Acadia Parish, Coastal Louisiana. Location is for 1 Onezime Doucet, in 6-8s-3e.

Dorris Ballew, Inc., Natchez, Miss., will drill Phillips Petroleum Co.'s projected deep wildcat test in southeastern Stone County, southeastern Mississippi. The test, 1 Dantzler, in 8-4s-10w, is scheduled to go to 11,700 ft. for a look at the Lower Cretaceous formations. Location is 7 miles east of McHenry, and about 12 miles southeast of Wiggins.

Woolf & Magee, Tyler, Tex., will drill a 6,600-ft. Wilcox test for Carter Oil Co. at Deer Park, in Concordia Parish, eastern Louisiana. It will be at 1 Graham, in 45-5n-9e, on the northeast flank of the field.

R. V. Muckelroy & Son, Lockhart, Tex., have contracted for four wells to be drilled in the old Zobrowski-Glass area 8½ miles southeast of Seguin, in Guadalupe County, Southwest Texas. The wells, first of which already is drilling, will be for J. Paul Massart, of Jennings Oil Co., and associates. All will be in the Glass sector, ¾ mile south of Zobrowski field, where Mas-

bargain thread dope?

Is cheap thread dope really a bargain? Tool joint and drill collar thread wear can cost a lot over a year's time. Fishing jobs come plenty high. Galling or washouts mean hundreds of dollars of extra expense. 'Bestolife Lead Seal stretches thread life, cuts down on fishing jobs, galling and washouts. That's why it's the most widely used lead base thread compound in the world. Get 'Bestolife at your supply store. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

I. H. GRANCELL
1601 EAST NADEAU STREET
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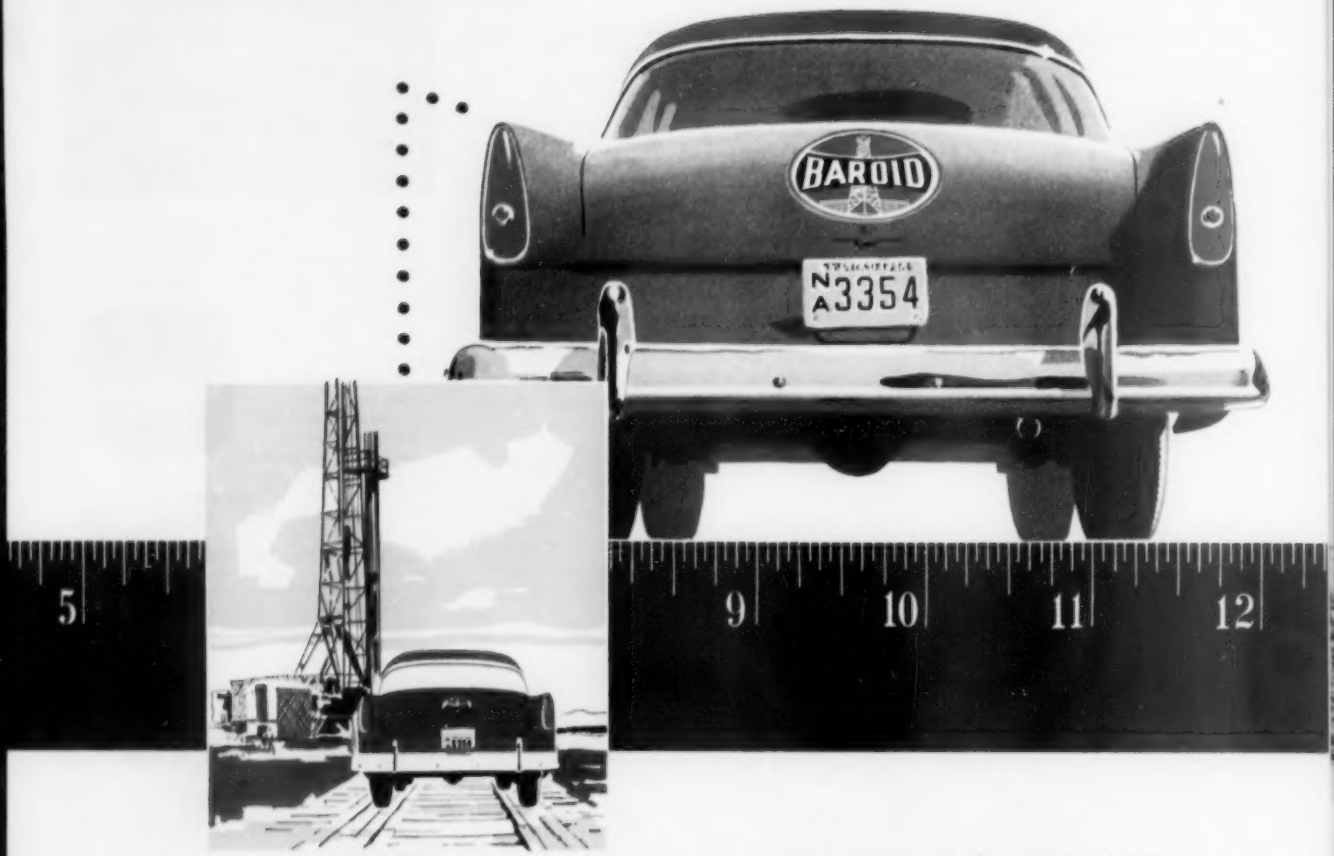
INFERNO

REFLEX GAGE HAS EXTRA HEAVY GLASS

The INFERNO "Clamp Type" gage has wider, heavier glass than the ordinary reflex gage. This is a distinct advantage when water conditions are bad. Malleable iron clamps cover entire side of gage. Clamp action is applied so that force is spread over entire length of glass, eliminating breakage due to tightening set screws unevenly. Write for new Bulletin No. 34.

THE INFERNO CO.
Box 1138A
115 RICOU St.
SHREVEPORT, LA.

SERVICE IS THE RULE



*Reprinted from Baroid Weighting Material Handbook published in 1930: "...Our Engineers will be pleased to assist you at any time with any of your drilling fluid problems. For service, information or material, call FAber 0768 at any time of the day or night . . ."

Since the beginning of the drilling mud industry Baroid Field Engineering has set the industry service pattern. Baroid established this standard of service before 1930* — Another Baroid "First"

Standardize on Baroid and Baroid Service

BAROID

BAROID DIVISION • NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

sart drilled the sector's only well, completed several months ago as a Buda lime producer. The new drilling will be carried to the base of the Edwards, and holes will be diamond-cored in all important formations. Wells are to be drilled consecutively.

Nabors Drilling Co. has taken on a well-deepening job in Benson field, DeSoto Parish, northern Louisiana. It will be for Joe W. Brown, of New Orleans, at 1 Fain, in 1-10n-14w. Hole, abandoned in 1953 at 3,055 ft., will be carried to 6,400 ft. to test Glen Rose potentialities.

Appell Drilling Co., Alice, Tex., has contracted for a 4,000-ft. test to be drilled for John J. Pichinson and Elmer Stewart, of Corpus Christi, at a wildcat location 15 miles north of Roma, in Starr County, Southwest Texas. Location is for 1 Guerra & Son, in Share 78, Porcion 59.

Maxwell Herring Drilling Co. has a rig under contract to Tide Water Associated Oil Co. for a 7,000-ft. Rodessa test 5½ miles northwest of Longview, in Gregg County, East Texas. The test is designated as 1 Castleberry Unit. Location is in the Dolores Sanches Survey.

Wheless Drilling Co., Shreveport, has a new wildcat operation scheduled in northwestern Tensas Parish, eastern Louisiana. It is a contract job for Benedum-Trees Oil Co. Location is at 1 McKinney, in 19-13n-10e. It is about 2½ miles southwest of Newlight field, 15 miles southeast of Winnsboro, Franklin Parish. Hole will be carried to about 7,500 ft. for a test of the Tuscaloosa.

H. L. Rowley, Inc., Shreveport, has contracted for two additional wells Atlantic Refining Co. will drill in Locust Ridge field, in Tensas Parish, eastern Louisiana. Both wells will be drilled to the Massive Tuscaloosa zone between 9,000 and 9,300 ft. The Rowley firm, drilling for its own account, discovered the field in November 1954. Marvin Ellis will be Rowley's tool pusher on the two wells.

Dillard & Waltermire Drilling Co., Houston, will drill a 15,000-ft. wildcat test in Acadia Parish, southern Louisiana. It will be for the contractor's own account with location at 1 Boudreaux, in 17-10s-2e, about 4 miles southeast of Crowley, in the southeastern part of the parish. It is about 3½ miles east of South Crowley field, and about 1½ miles from the Lafayette parish line.

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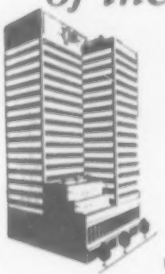

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OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

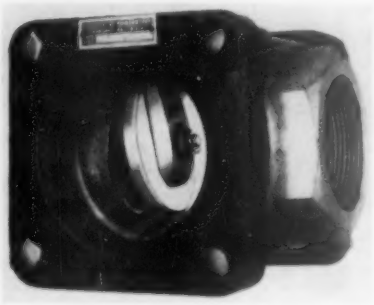
Aero Introduces Super Commander

A new model Aero Commander executive airplane is powered by twin supercharged engines and is capable of a top speed of 260 m.p.h. The model 680 Super will cruise at a speed of 230 m.p.h. at 10,000 ft. at 70 per cent hp.

The engines for the new model are Lycoming GSO-480-A1A, each developing 340 hp. for takeoff and a continuous normal rating of 320 hp. It is a geared-drive, six-cyclinder, horizontally-opposed, supercharged, dry-sump, air-cooled engine, with side mounted accessories.

Besides the exceptionally high cruising speed, the new plane has many other high performance features. It has a normal range of 1,400 miles and a maximum range of approximately 1,600 miles, which makes it possible to span the continent with only one stop. Gross weight is 7,000 lb. with a disposable load of 2,750 lb. It will carry a total of 230 gal. of fuel.

It provides a high degree of comfort and flexibility in the spacious cabin with optional seating arrangements for six to seven people or a five-place arrangement with two full-length lounges and special provisions for an icebox, toilet, and tuckaway table. All of the seats can be removed from the cabin in less than 15 minutes to convert the plane for cargo use. For flying at altitudes above 12,000 ft., a special console oxygen system has been installed as standard equipment. **For more information write or call: Aero Design & Engineering Co., Tulakes Airport, Box 118, Bethany, Okla.**



Sight-Flow Indicator Gives Positive Backflow Check

A sight-flow indicator combines flow indication with positive check of backflow. Designated as Fig. 213 Bull's Eye check-valve indicator, the device has a self-aligning soft-seat flapper which prevents backflow. Two ½-in.-thick windows on opposite sides of the body, removable for easy cleaning, show clearly whether or not there is a flow. The indicator does not measure rate of flow.

The indicator, primarily designed for LPG and anhydrous ammonia service, has been approved by U. S. Testing Laboratories for LPG service. It may be used for other applications requiring flow indication with positive check of backflow. The rugged, through-bolted construction is suited for severe

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service in the process industries and permits cleaning the sight glasses without removing the unit from the pipeline.

Standard sizes are for 2-in. pipe, with an operating pressure rating of 250 psi., and for 1½-in. pipe with a rating of 300 psi. Indicator bodies are of bronze or steel and gaskets of Thiokol. **For more information write or call: Fischer & Porter Co., 544 Jacksonville, Road, Hatboro, Pa.**

●

New Tool Cleans Interiors By Sand Blast System

A new sand-blasting tool for the cleaning of pipe and tube, called the Torno-Blast sandstorm pipe-cleaning system, is the first successful application of the sand-blasting principle for cleaning the interior diameter of pipes and tubes.

Torno-Blast cleans the inside wall of pipes and tubes by whirling sand or other abrasive substance under great pressure inside the pipe. The Torno-Blast tool uses a conical diverter which disperses the abrasive material over 360° and can clean the interior of pipe by passing the tool through the pipe. It does not need to be rotated nor is it necessary for the pipe itself to be turned.

The tool is available in four sizes: Model 100 for cleaning ½ to ¾-in. pipe and tube, Model 200 for ⅞ to 1½-in. pipe and tube, Model 300 for 2 to 4-in. pipe and tube, and Model 400 for 4 to 12-in. pipe. **For more information write or call: Walter Smith, J. C. Fennelly Co., 1485 Bayshore Boulevard, San Francisco, Calif.**

●

Remote Temperature Reading Added to Telepulse System

This new remote temperature-reading system, designated as ST-8900, can be installed as a separate, complete system for remote temperature reading, or in conjunction with the Telepulse system for remote liquid level gaging.

It gives accurate, remote temperature reading from any point where communication facilities can or do reach, such as private or leased wires, carrier, or microwave. When added to existing Telepulse remote gaging systems, it requires a minimum number of additional local lines, and shares some of the existing ones.

Remote temperature readings are obtained in a manner similar to remote gaging. A start or trigger pulse is sent from the control or reading station. This pulse starts the transmitter, wherever it may be, on its indicating cycle. This involves three phases: (1) a series of pulses that start the process of temperature reading at the particular transmitter selected; (2) another series of pulses positively identifying the transmitter and confirming its selection by sending appropriate signals back to the control station; and (3) a series of pulses sent back to the control station giving a direct indication of the temperature of the product being measured. These last pulses set up an indicator at the control station which shows an accurate temperature reading. At the conclusion of this three series of pulses, the temperature transmitter resets itself to readiness for repetition of another measuring cycle. **For more information write or call: Shand & Jurs Co., Berkeley 10, Calif.**

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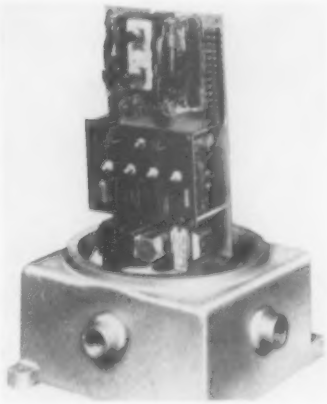

Micro-Valve Designed for Bleeding, Metering Control

A high-pressure valve with a micrometer stem is perfect for bleeding and metering pressure letdown control. This valve permits true micrometer control of all types of testing through the principle of differential screw threads. The slightest turn of the handle makes dial settings an easy-to-read record.

Orifice opening is so delicately measured that one complete revolution of the handle only opens the valve .015 in. There is a positive stop at zero; therefore, the valve cannot be thrown

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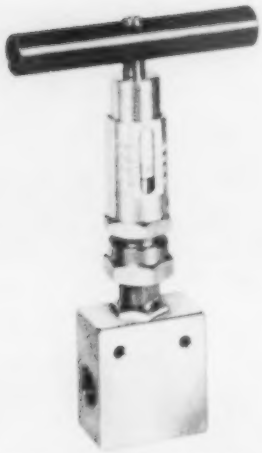


out of alignment or the seat ruined by over-tightening. Except for chemical changes of corrosion and erosion, it is now possible to duplicate with certainty all tests and readings.

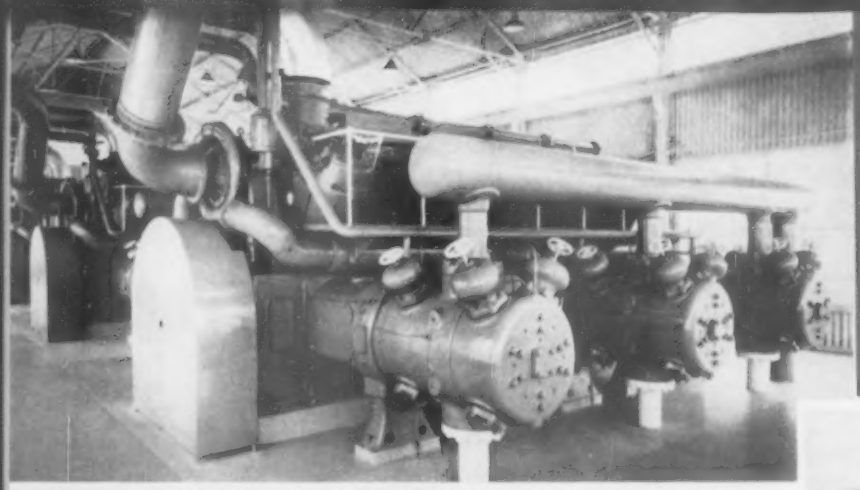
The Micro-Valve is manufactured in all types of materials including stainless steel, Hastalloy, and titanium for vacuum and pressures up to 60,000 psi. It is available in a complete range of tubing sizes up to and including ¾-in. **For more information write or call: High Pressure Equipment Co., Inc., 1222 Linden Street, Erie, Pa.**

•

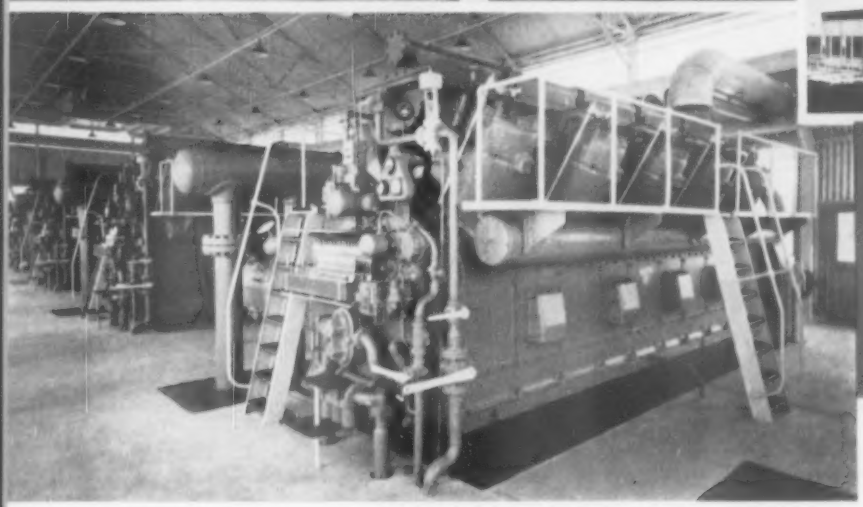
Valve Actuator Increases Electronic Advantages

An electrohydraulic valve actuator for electronic controllers considerably increases the advantages of electronic control systems.

This actuator is a complete self-con-



These installation photos show the new Cooper-Bessemer GMVA compressors which are identical in both the Keyes, Oklahoma and Springfield, Colorado transmission stations of the Colorado Interstate Gas Company. Below are exterior views of the compact Keyes (left) and Springfield (right) stations.



Another Example of Efficient Power at Lower Cost

The latest for Colorado Interstate Gas . . .

COOPER-BESSEMER GMVA's

for new highs in compressor performance

● Two important transmission stations of the Colorado Interstate Gas Company have installed new Cooper-Bessemer GMVA compressors with centrifugal blowers.

Both the Springfield, Colorado and Keyes, Oklahoma stations are equipped with four of these big, modern 10-cylinder GMVA's rated 1350 hp at 300 rpm. The GMVA compressor is an *even better, smoother operating* unit than the well-known GMV it replaces.

With the GMVA, there's a 10% reduction in fuel consumption, good air ratio to all loads, higher horsepower ratings with no space increase, operation on a variety of fuels, ample working space around power cylinders . . . and many other advantages that add up to increased compressor operating efficiency and reduced maintenance demands in the 540-1350 horsepower range.

For further information on the dependable and economical GMVA, drop in, or write to any of the conveniently located offices listed below. You'll be especially interested in Cooper-Bessemer's new, complete GMVA Catalog No. 75. Write for your copy today.

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tained unit including control valve, hydraulic power source, and proportional-positioning mechanism which can be used with existing electronic controllers. Outside connections consist of the signal wires from the controller and an electric power supply. The signal current is applied to a high-resistance coil (3,000 ohms or more) which moves in a magnetic field. Linked to the coil is Askania's jet pipe which converts an electrical signal of less than 50 milliwatts into the powerful stroke of a control valve. The valve moves at a speed of better than 1 in. per second. Thrusts of 600 lb. and more can be handled, with strokes presently available up to 2 in. **For more information write or call: Askania Regulator Co., Information Service, 240 East Ontario Street, Chicago 11, Ill.**

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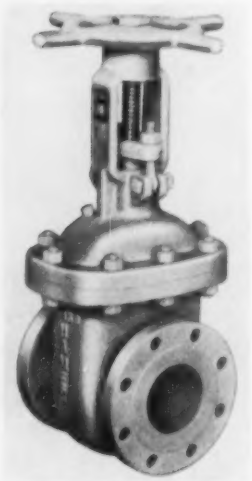


New Gate Valve Provides Impenetrable Shutoff

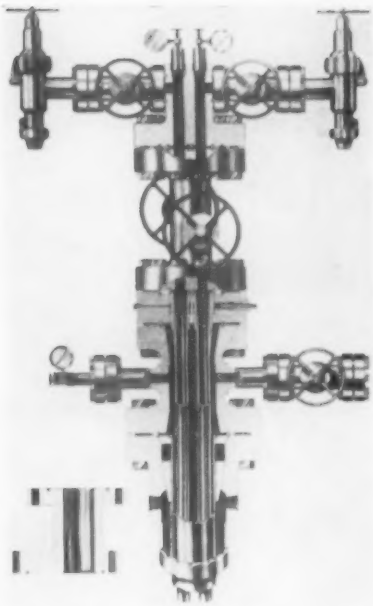
An all-new gate valve designed to overcome the inherent disadvantages of conventional gates has already been proven by many of the country's major refineries and chemical plants. The new gate valve provides impenetrable line shutoff, both on the upstream and downstream side of the wedge.

In addition to the precision metal-to-metal contact of the wedge and valve body seats, the new valve incorporates a pair of Teflon packing seals which press deadtight against the wedge, forming an impassable seal. Stainless-steel locking rings and seats have made the valve impervious to corrosive fluids moving through the line.

Replaceable stainless-steel seat is lightly welded into the valve body to insure against leakthrough. Machined to precision tolerances, the new valve is smooth operating and requires only a minimum of maintenance to keep it in top operating service. The valve is easily serviced in the line if and when necessary. **For more information write or call: Hamer Valves, Inc., Box 1851, Long Beach 1, Calif.**

Dual-String Hanger Flange Uses Metal-to-Metal Seal

A new dual-string hanger flange utilizes the metal-to-metal seal on tubing strings for dual completions. Featuring simplicity in design, it allows the operator complete flexibility to meet all requirements of safety and economy in dual-completion work utilizing two individually suspended strings of tub-



ing. The hanger flange has two separate full-opening bores, in which the threaded mandrels seat and suspend the tubing. The mandrels are furnished with an O-ring to effect a temporary seal during completion work. It is also grooved for a holddown locking screw. The top of the mandrel has one-half of a seal-ring groove, with the other half in the hanger flange. When the mandrel is landed in the flange, a metal seal ring seated in the groove at the junction of mandrel and flange provides a metal-to-metal seal when the valve is flanged in place. Regular 2-in. A.P.I. upset tubing can be run or pulled through bores in the flange. Holddown locking screws in the flange are optional, and the use of an adapter through the locking-screw opening permits testing the seal.

These hanger flanges are available in nominal sizes 6 and 8 in any series. A special offset adapter spool permits use of regular preventer equipment with alignment over each individual bore while running and pulling tubing. After first string is run, adapter spool can be rotated to center directly over the other bore. **For more information write or call: Rector Well Equipment Co., Inc., 1100 North Commerce, Fort Worth, Tex.**

•

Indirect Heaters Designed For Several Field Jobs

A new line of 10 to 24-ft.-long indirect heaters have rated heating capacities ranging from 250,000 to 4,000,000 B.t.u. per hour. These indirect heaters are designed to perform a number of oil-field jobs, among them the prevention of hydrate formation in both gas and gas-condensate streams of transmission or production systems.

Thermal stresses in the new heaters are eliminated by the single-end mounting of both the fire boxes and the flow coils. Other features include condensers designed to reduce water loss and preheater coils which eliminate hydrates in the unit's fuel gas lines.

New thermostatic controls insure peak efficiency of water bath temperatures. Rated heating capacities of the units are 250,000, 500,000, 800,000 1,000,000, 1,500,000, 2,000,000, and 4,000,000 B.t.u. per hour. Water capacity of the heaters ranges from 180 to 2,470 gal. **For more information write or call: Delta Tank Manufacturing Co., Inc., Oil Field Equipment Division, Choctaw Road, Baton Rouge, La.**

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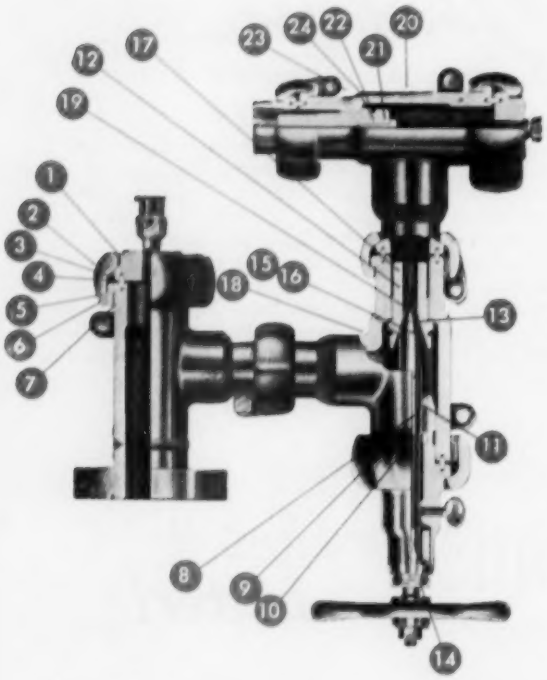

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7	Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in tee if desired.	19	Wing Valve stem seat sealed by power threads and metal gasket assures alignment.
8	Stem packing needs no tightening.	20	Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated.
9	Stem turns freely under high pressures.	21	Shaped entrance on beans prevents paraffin clogging.
10	Threads on stem not exposed to external or internal damage.	22	Positive Choke Body may be replaced with inexpensive tee and cage nipple.
11	Full 2½" pilot for true stem alignment and rigidity.	23	Positive Choke Body can be converted to Adjustable Wing Valve by substituting two parts.
12	Streamlined flow — no obstructions . . . no turbulence.	24	Beans and stem seats have external hex for wrenching.

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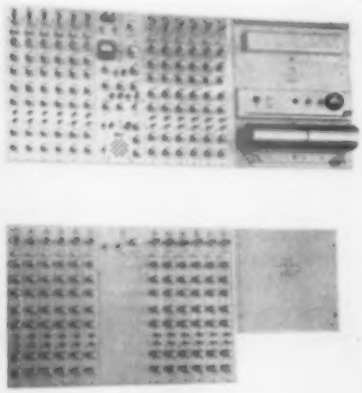

New Seismograph Replaces Three Seismic Systems

The new G-33 full-spectrum seismograph system combines, in one instrument, all the functions previously filled by three separate seismograph systems. Since it covers the seismic spectrum over the entire range of frequencies from 4 to 600 cycles per second, the G-33 can be used for refraction, conventional reflection, and high-frequency recording with no additional equipment required. The new system has been several years in development and utilizes all of the circuitry and construction techniques originated by SIE for its G-series equipment which feature low distortion and low noise-level characteristics, as well as light weight and small space requirements.

Filtering covers this wide band with two attenuation rates for both high and low frequency cuts. Automatic gain control time constants are provided for each recording technique. A variable-speed oscillograph allows the use of the same instrument in all three applications. Hermetic sealing of critical components and aluminum construction insure trouble-free field operation. **For more information write or call: Southwestern Industrial Electronics Co., 2831 Post Oak Road, Houston, Tex.**

•

New Galvanizing Material Can Be Brushed or Sprayed

A 95 per cent pure zinc coating is applicable with a brush or spray gun to standing structural parts, for the purpose of renewing galvanizing on parts that have lost the original protective coating or of applying a zinc protection to standing towers, fences, or ducts which, being already in position, could not otherwise be zinc coated. **For more information write or call: Wilbur & Williams Co., 130 Lincoln Street, Boston 35, Mass.**

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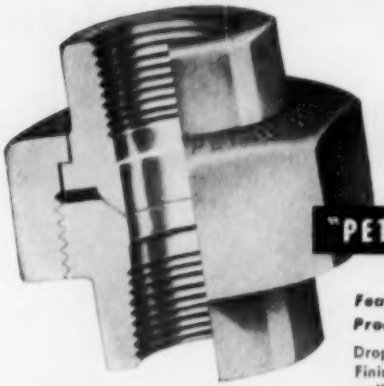

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Indianapolis 25, (S) Indiana Oil Equip. Co., Inc. 417 Madison Avenue Phone MElrose 5-9367
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New Orleans 12, (S) Menge Pump & Mach. Co. 549 Bryades St. Phone CAnal 4861
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Somerville 43, (S) Hayes Pump & Mach. Co. 100 Vine St. Phone HOnument 6-3886
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Detroit 26, (S) Kerr Machinery Co. Kerr Building Phone WOodward 1-0598
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Minneapolis 3, Reed Hart 115 East 16th St. Phone BRidgeport 7582
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Bobbs, (S) (Also Artesia) Union Supply Co., Inc. Phone 3 3103
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Cincinnati 2, (S) Wm. T. Johnston Co. 214 Vine St. Phone GArfield 6262
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VIRGINIA
Richmond O'Neill Pump & Eng. Co. 601 E. Franklin St. Phone 7-4828
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Marshfield, (S) Felker Bros. Mfg. Co. Phone 230
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Asbestos Safety Clothing is a 12-page booklet describing in detail the various articles of safety apparel manufactured and supplied by Johns-Manville. These include asbestos suits, helmets, aprons, leggings, overshoes, and the Wearbestos line of gloves and mittens which are specially treated to increase resistance to heat, oil, water, and abrasion. **For more information write or call: Johns-Manville, 22 East 40th Street, New York 16, N. Y.**

●

A Guide for Selecting an Engineering Firm. The booklet has been prepared for those who are responsible for their company's entering new product fields, for plant automation, modernization, or expansion, and for those who need outside engineering help. The booklet differentiates between the engineering-installation firm, the project-engineering firm, and the engineering-design firm. It sketches the criteria for determining whether the present engineering staff is adequate to do the job, and then outlines guide posts for selecting an outside engineering firm. A section of the discussion is also devoted to what management can expect from the engineering firm which it hires, in the way of work output and time and money spent. The final half of the book describes Teller engineering services, including machine design and fabrication, equipment layout, procurement, installation, training of operating personnel, and general consulting services. **For more information write or call: Teller Co., Group P, Butler, Pa.**

●

New Speedomax H Electropneumatic Controllers Current-Adjusting Type. Complete information about the new Speedomax H electropneumatic controllers, current-adjusting type, is now available in a four-page data sheet. This new sheet, ND46-33(106), describes how this control system combines the advantages of pneumatic control with the flexibility and fast response of an electrical system. Included in the sheet is a full description, complete with line drawings and photographs, of the

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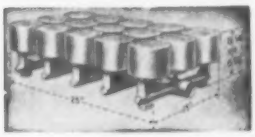

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•

Temperature Control Catalog. A new condensed catalog, G-20, covers a complete line of differential expansion temperature controls. Included are pictures of all the current types, a description of their operation, general specifications of the entire line, and an instrument-selection chart. The instruments shown are suitable either for controlling temperatures or for high-temperature safety alarms and cutouts. Both electric and penumatic types are included, as are ranges from subzero to 1,800° F. **For more information write or call: Burling Instrument Co., 16 River Road, Chatham, N. J.**

•

Kel-F Fluorocarbon Oils, Waxes, and Greases. The chemical structure, specifications, properties, applications, and general description of a new group of fluorocarbon oils, waxes, and greases for industrial use are described in this new 16-page booklet. Rapid advances in industrial technology are placing ever-increasing demands on plant equipment and machinery, the booklet points out. Operating temperatures continue to expand in both directions, and pressures to increase, so that processing materials create corrosive conditions of growing severity. **For more information write or call: Chemical Manufacturing Division, M. W. Kellogg Co., P. O. Box 469, Jersey City 3, N. J.**

•

Hankison Condensifilters for Instrument-Quality Compressed Air. A moisture-vapor content chart which enables evaluation of the water vapor in a compressed air system is included in a new four-page bulletin, M-7155. The Condensifilter Models M-100 and M-30 illustrated in the bulletin clean and dry compressed air by the use of an internal condenser in combination with a disposable filter cartridge in a heavy gage steel casing. **For more information write or call: Hankison Corp., 242 Biltimore Building, 951 Banksville Road, Pittsburgh 16, Pa.**

•

PVC Pipe Fittings and Flanges. Unplasticized polyvinyl chloride (PVC) pipe fittings and flanges are the subject of this new booklet. It discusses in-

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dustrial applications of PVC piping and gives complete specifications for threaded and socket types of PVC fittings, and PVC flanges, in both normal and high impact grades. The booklet also lists the many major industries that are using PVC piping on a rapidly increasing scale and includes installation information, pressure-temperature charts, chemical resistance tables and other helpful reference data. **For more information write or call: Tube Turns Plastics, Inc., 2929 Magazine Street, Louisville 11, Ky.**

•

General Purpose Valves. Complete information on the new series Vogt GP general purpose drop-forged steel valves, gate, globe, and angle types, sizes ¼ through 2-in., is contained in Supplement 1 to Vogt's catalog F-9. **For more information write or call: Henry Vogt Machine Co., P. O. Box 1918, Louisville 1, Ky.**

•

Wire-Rope Straightener, a data sheet, illustrates and explains a portable hand-operated machine that removes bends, twists, loops, and kinks from all sizes of cable. **For more information write or call: James B. Burke, Cable Strate Co., Phone DAvenport 3-2763, P. O. Box 351, Menlo Park, Calif.**

•

Kelloggram. The step-by-step story of how a 90-ft., 306-ton deresining tower was raised in the midst of an operating refinery, while operations were dovetailed with a tight downtime schedule, is the subject of the latest Kelloggram. Contrary to conventional practice in which large towers are fabricated in the field, this unit was completely shop fabricated and shipped in one piece. The tower was temporarily reinforced and modified before it ever left the shop. Of special interest are a diagrammatic presentation of the detailed steps in construction and a table showing a summary of load variations during the erection of the tower. **For more information write or call: M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.**

•

Piston Packing. A new and comprehensive 16-page data bulletin covers Darcova Pumcups for packing pistons of air cylinders, hydraulic cylinders, and reciprocating pumps. This new bulletin, No. 5503, goes far in giving the kind of information required by engineers and men responsible for the performance and maintenance of equipment and machinery throughout industry. Included are operating diagrams and a list of typical installations, as well

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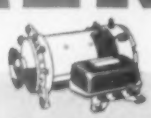

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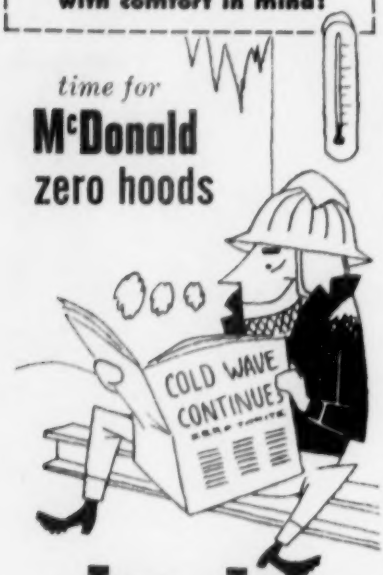

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●

Primary Cementing Tools explains cementing procedures and illustrates the advantages of the company's scratchers and centralizers engineered for specific applications. Line drawings illustrate the location and installation of scratchers and centralizers. The bulletin also shows a method of figuring costs of scratchers and centralizers per foot of cement. **For more information write or call: B and W, Inc., Phone WA 3-6603, P. O. Box 5266, Houston 12, Tex.**

●

Otis Safety Valves, an eight-page, multicolor brochure shows design, operation, and installation diagrams of the Type X full-opening gate valve that is pressure-operated to close automatically in case of abnormal pressure changes; the Type C safety valve for flow lines not requiring full-opening valves, and removable tubing safety valves for automatic subsurface protection against wild, uncontrolled flow. **For more information write or call: Otis Pressure Control, Inc., Phone DIxon 3911, P. O. Box 7206, Dallas, Tex.**

●

Unitary Mechanical Seals. Bulletin AD-151, a 12-page catalog, describes the advantages of Unitary seals: one-piece assembly, preset at the factory, collett-type drive, external lock and drive, circulating connections in glands, and long life. Unitary seals are designed for use on rotary shafts of boiler-feed pumps, chemical pumps, refinery pumps, digestor circulating pumps, and other process pumps. **For more information write or call: Garlock Packing Co., Palmyra, N. Y.**

●

HD-21 Diesel Crawler Tractor. Engineering, design, and performance features of the new HD-21 diesel-powered crawler tractor are described in the new 16-page two-color catalog, MS-457. Many photographs and illustrations are included as pictorial aids in telling the HD-21's technical and operating story and to describe the new 204 net engine hp. diesel engine which powers the tractor. Also listed is the matched equipment and the complete line of accessories. **For more information write or call: Allis-Chalmers Manufacturing Co., Tractor Group, Construction Machinery Division, Milwaukee, Wis.**

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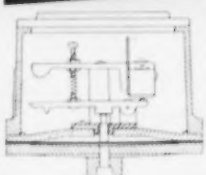

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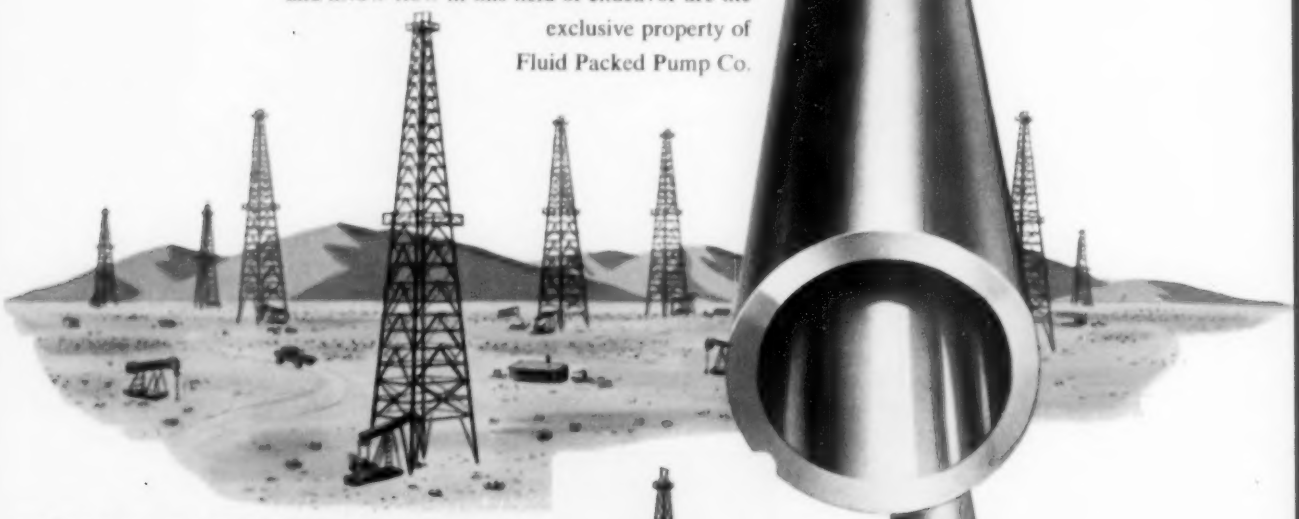

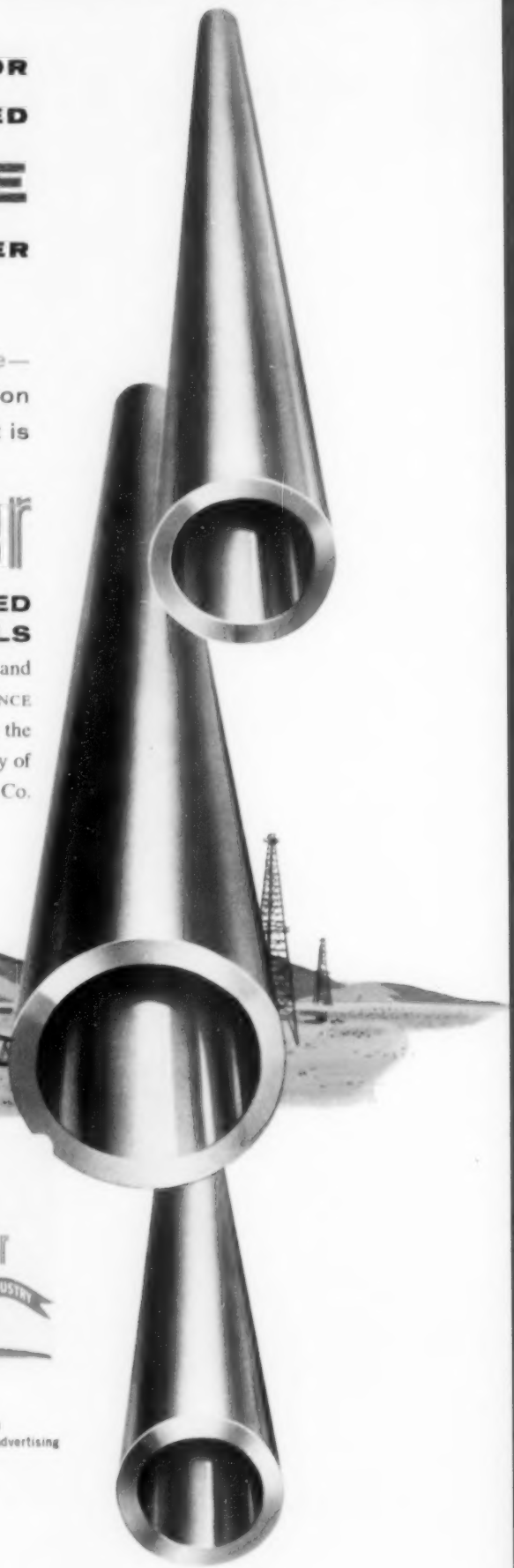

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EQUIPMENT MEN . . . in the News

Durkee Elected President, California Manufacturers

Election of Rodney S. Durkee, chairman of the board of Lane-Wells Co., as president of the California Manufacturers Association, was announced recently. He will hold this important post for the 1955-56 fiscal year. Durkee is also a director and a member of the executive committee of Dresser Industries, Inc., of Dallas, who own Lane-Wells Co. He was president of the Petroleum Equipment Suppliers Association for 1954 and served two terms as a director of the American Petroleum Institute.

Durkee is a member of the executive committee of the Metropolitan Traffic and Transit Committee of the Los Angeles Chamber of Commerce; advisory board of International Accountants Society; American Institute of Mining and Metallurgical Engineers; American Ordnance Association; American Institute of Management; Petroleum Production Pioneers; and Chamber of Commerce of United States.

Knight-Gordon Represents Aldrich in Three States

R. H. McPeak, sales manager, Aldrich Pump Co., Allentown, Pa., has announced the appointment, effective November 15, 1955, of Knight-Gordon Engineering, Tulsa, as representatives for Oklahoma, Kansas, and Arkansas. Knight-Gordon Engineering is headed by A. H. Knight, formerly with Cardwell Manufacturing Co., and M. J. Gordon, recently retired from USAF. Complete field stocks will be maintained for Aldrich Pumps by Knight-Gordon Engineering.

J&L Supply Shifts Pauls Valley Store to Lindsay

Rainey Elliott, president of Jones & Laughlin supply division, Tulsa, has announced the transfer of store stocks at the firm's Pauls Valley, Okla., store to Lindsay, Okla. The move was recently effected to enable the J&L supply division to broaden its scope of oilfield supply service from a more central point in the central and southern Oklahoma district.

D. H. Saltzmann has been appointed store manager. He will be assisted by storemen, B. L. Parker, R. L. Parks, and K. C. Modenbach, Jr. Serving this area as the firm's sales representatives are R. B. Bayless and W. R. Woodward.

Operations of the division's new store will be under the over-all supervision of L. R. Roberts, district sales manager of the central and southern Oklahoma district.

The building shown is the new J&L supply division store located on a railway right-of-way at Lindsay, Okla.

Union Tank Announces Four New Appointments

Kenneth A. Woodard has been appointed district manager of the Houston district, it has been announced by H. L. Paale, vice president and general sales manager of Union Tank & Supply Co., Houston. Francis J. Hencke has been appointed district manager, it has been announced by C. F. Williams, regional manager at Dallas. Leonard L. Beck has been appointed branch manager of the Sterling, Colo., branch, it has been announced by E. E. McDonald, regional manager. Thomas W. Landry has been appointed city salesman in Houston.

K. A. WOODARD

F. J. HENCKE

Prior to assuming his new duties, Woodard was in the engineering department and city sales department at Houston for 5 years. Before his new appointment, Hencke was sales representative for West Texas and New Mexico.

Beck was formerly a field man for Union Tank & Supply in the states of Kansas and Colorado. Before joining Union Tank & Supply, Landry was an industrial engineer for Cameron Iron Works at Houston.

Oilwell Announces Assignment Of Two Representatives

Appointments of two field representatives in the Gulf Coast area of U. S. Steel's Oil Well Supply Division have been announced by M. F. Jones, area manager.

Named field representative at Lake Charles was James S. Necessary, formerly store manager at New Iberia, La. Robert E. Beattie, manager of Oilwell's Houma, La., store, becomes field representative at Beaumont, Tex.

Necessary joined Oilwell at its Jennings, La., store in 1948. He became field representative at Jennings later that year and subsequently served in that capacity at Lake Charles, La., and New Iberia. He has been stationed at

Homco Opens Supply, Service Point

Homco has opened this new oil-field supply and service point located just outside of Sherman, Tex., on Highway 75. C. M. Hart is the division sales manager. R. M. Dupree is the store manager. J. O. Redmon is the district manager for the service department. A complete line of oil-field supplies and equipment as well as fishing or cutting, electronic string-shooting and oil-well surveying tools are made available to the North Texas-Oklahoma area.

35 EXCHANGERS
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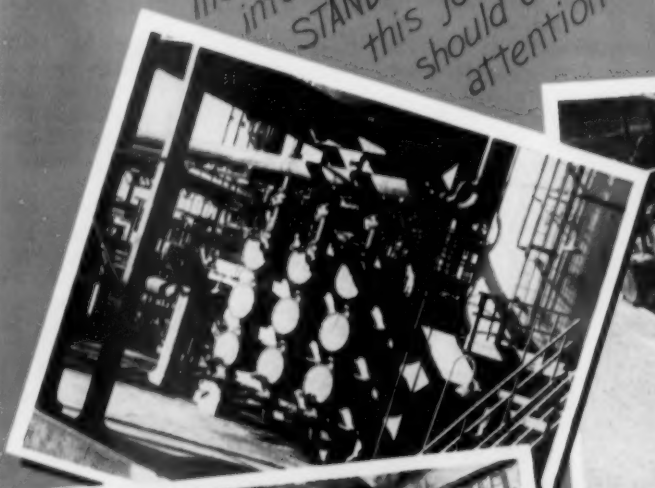

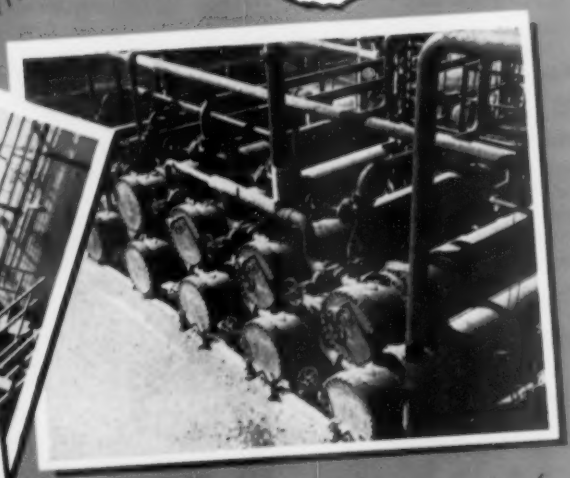

Here are the photos of the 35 exchangers

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New Iberia since 1950, becoming store manager there in 1953.

Beattie was employed by Oilwell in 1948 at Houston. He was appointed manager of Oilwell's Eunice, La., store in 1950 and took leave that year for service with the Air Force, rejoining the organization in 1951 as field representative at Beaumont.

Electro-Motive Names H. P. Gustavson to Sales Post

H. P. GUSTAVSON

Appointment of Harold P. Gustavson as petroleum equipment sales manager of Electro - Motive Division of General Motors is announced by Paul R. Turner, director of sales of Electro-Motive. Gustavson, who has been in locomotive sales as a district sales manager of the firm's New York region, is now in charge of sales for Electro-Motive's recently announced diesel-electric power units for oil-well drilling. His headquarters are in Tulsa.

At the same time, Turner announced two additional appointments to expand Electro-Motive's service to the drilling industry: appointment of Arthur M. Hazell, Jr., as sales representative for petroleum equipment with offices in Houston, and appointment of R. H. Beight as technical engineer, with headquarters in Fort Worth.

Gustavson has been with Electro-Motive since 1940, starting in locomotive test. In 1940 he transferred to the engineering department and in 1950 was transferred to the sales-engineering section of the sales department. In 1951 Gustavson was promoted to district sales representative in the New York region and in 1953 he was promoted to district sales manager, New York.

Hazell started work for Electro-Motive Division in 1936 as an assembler's helper. In 1938 he transferred to engine assembly and the next year was promoted to service instructor. In 1942 he became personnel instructor in the service department and, following return from military leave in 1946, he became a service engineer. He was promoted to district engineer in 1949 and in 1952 was made sales representative, New York region.

Beight joined Electro-Motive in 1939 as a service instructor after 11 years in the steel industry. He subsequently became personnel instructor in the service department and in 1945 was promoted to personnel engineer for service. In 1946 he was promoted to district engineer.

Hydril Promotes Gillham To District Sales Position

Hydril Co. has announced the recent promotion of J. B. Gillham to district sales supervisor for the West Texas - Permian basin territory, with headquarters in Midland, Tex.

Gillham started with Hydril Co. in the Los Angeles sales office. Later he was transferred to the Southwest Texas area, working out of the Houston office, and in 1946 he was moved to Midland to represent the company in West Texas.

Royston Makes Strothman Regional Engineer

Royston Laboratories, Inc., Blawnox (Pittsburgh), Pa., manufacturers of corrosion-resistant coatings, has announced the appointment of Harry N. Strothman as regional sales engineer in charge of the new Chicago office.

Strothman, who transferred from Royston's Pittsburgh headquarters, possesses a wide knowledge of the protective-coating and corrosion-engineering fields.

Maddox Is Made Sales Manager for Pipelife

MEL MADDOX

The appointment of Mel Maddox as sales manager of Pipelife Corp., Tulsa, has been announced by R. J. Lyons, president. Maddox has been in the pipeline industry for over 10 years in sales and service of protective coatings, pipeline supplies and equipment.

Maddox was previously district manager of Pittsburgh Coke & Chemical in Atlanta, and was 5 years with Reilly Tar & Chemical Corp. His experience covered Midwest and South protective coating sales and coal tar chemical sales for that organization.

Templeton-Kenly Adopts Jack Service, Repair Plan

A new hydraulic-jack repair service plan has been adopted by Templeton-Kenly & Co. which makes it easier for users of Simplex hydraulic jacks to get fairly priced repairs in the field with genuine factory parts. Under the plan, carefully selected jack repair shops in all important industrial areas are being franchised by Templeton-Kenly as factory-authorized service depots.

Each authorized service depot can be identified by a special insignia which will be prominently displayed by the shop. According to a Templeton-Kenly spokesman, this new plan with its positive identification of qualified service depots will help to insure honest, dependable repairs by men who have been especially trained to service Simplex hydraulic jacks.

Hunter Made General Sales Manager, Detroit Diesel

R. E. HUNTER

Appointment of Robert E. Hunter as general sales manager of the Detroit Diesel Engine Division of General Motors has been announced by Semon E. Knudsen, general manager of the division. Until this appointment, Hunter had been director of sales of General Motors Diesel, Ltd., of Canada.

Hunter first joined General Motors in 1937 as business-management manager at the Pontiac Motor Division. He transferred to the Electro-Motive Division of General Motors as assistant director of industrial relations. He later became manager of the market-analysis and statistical section and then district sales manager in Chicago. In 1949 he joined General Motors Diesel, Ltd., of Canada.

Hunter replaces E. F. Bentley, who is going on special leave of absence.

Lufkin Moves Into New Canadian Headquarters

Lufkin Machine Co., Ltd., has moved into this new headquarters building at Edmonton, Alta., Canada. The new building has two overhead cranes, 4,000 sq. ft. of floor space, and 2 acres of land with 180 ft. of railroad siding. Lufkin Machine Co., Ltd., a Canadian corporation, is a subsidiary of Lufkin Foundry & Machine Co., Lufkin, Tex. Jack E. Gissler is resident manager of Canadian operations with headquarters at Edmonton and is assisted there by Len Ruzicki and Jack Leary. Bob Dunlop is now headquartering in Regina, Sask., and is manager of sales in Saskatchewan and Manitoba.

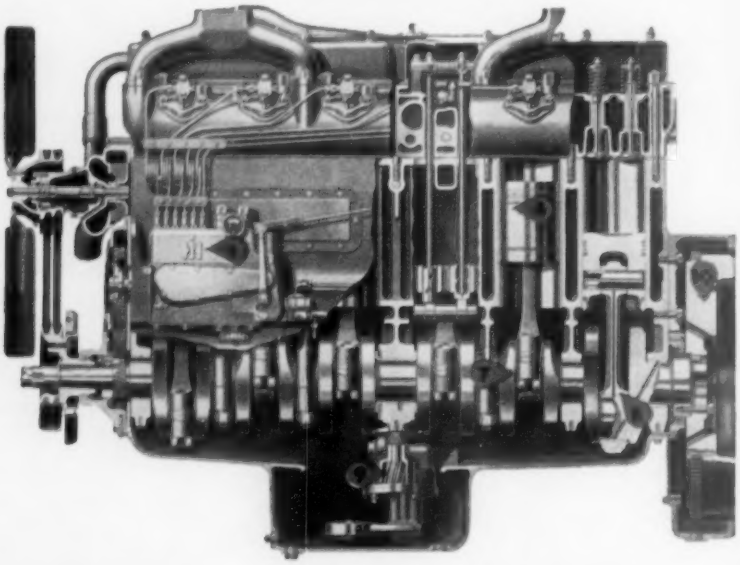
1 FULL FLOW OIL FILTER—Before oil goes under pressure to engine bearings, all harmful particles are removed by replaceable plastic-impregnated, full-flow filters.

2 POSITIVE ROTATORS EXTEND VALVE LIFE. Exhaust valve rotators keep valves turning, at all engine speeds, distributing heat uniformly around the valves to keep deposits from building up on stems and seats, and also to prevent sticking, scuffing, and burning.

3 POSITIVE ALL-WEATHER STARTING. Seconds-fast, International Diesels start in coldest weather on exclusive gasoline starting system. Cylinders are pre-heat conditioned to give complete, clean combustion, instantly, on switching to operation on Diesel fuel.

4 ALUMINUM-ALLOY PISTONS have a thick crown at the top for rapid dissipation of excess heat direct to the cooling water. Hardened, replaceable, cylinder sleeves, three compression rings, with top ring chrome-plated, plus two oil control rings assure long-lasting, gas-tight seal for high compression ratios of over 15 to 1 . . . providing top fuel and oil economy.

5 SIMPLE, SINGLE-HOLE, INJECTION NOZZLE and pre-combustion chamber set at 45° angle for smooth, clean combustion of low grade No. 2 fuel oil under all engine speed and load conditions.



6 NEW IH INJECTION PUMP: Single plunger type on four-cylinder models, twin-plungers on six-cylinders . . . provide all cylinders equal amounts of fuel, precisely metered to load, whether for idling, maximum horsepower, or maximum torque under overload. New, harder injection plungers have up to four times longer life.

7 HEAVY-DUTY FORGED CRANKSHAFT with large diameter, induction-hardened journals provides long-lasting, wear-resistant bearing surfaces . . . rifle-drilled for full pressure lubrication . . . dynamically balanced for smooth operation.

8 REPLACEABLE TRI-METAL BEARINGS provide precision clearance for full-pressure lubrication and thousands of hours of heavy-duty work. Smooth electroplating of white alloy metal over copper-lead, precision bonded to a steel back, carries heavy loads with minimum friction.

9 FULL-PRESSURE LUBRICATION for long life. Big, gear-type pump delivers oil under controlled pressure through full-flow filters and rifle-drilled passages to main and connecting rod bearings, piston pins, camshaft, timing gears, and valve rocker arms.

10 HEAVY FLYWHEEL helps to maintain uniform speed under widely varying load conditions. Available to match standard makes of clutches, fluid couplings, and torque converters.

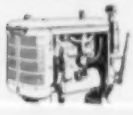
Hour after hour. . year after year

INTERNATIONAL ENGINES

. . . stay on the job with least upkeep

All International engines are built throughout to give you a full measure of power that stands up and stays on the job. They are precision-manufactured of thoroughly tested materials under continuous, quality-control inspection. Pressure lubrication through rifle-drilled crankshafts and internal passages assures trouble free performance. Inbuilt precision is fully protected from dirt and grit under the worst of job operating conditions by the best of fuel, oil, and air filters.

Heavy-duty radiators, power take-offs, and other factory-engineered power unit components are available to fit these long-life, money-saving engines to your job requirements. You can also get them as original equipment in most makes of construction machines. Call your nearest International Industrial Power Distributor or Power Unit Dealer for all the facts.



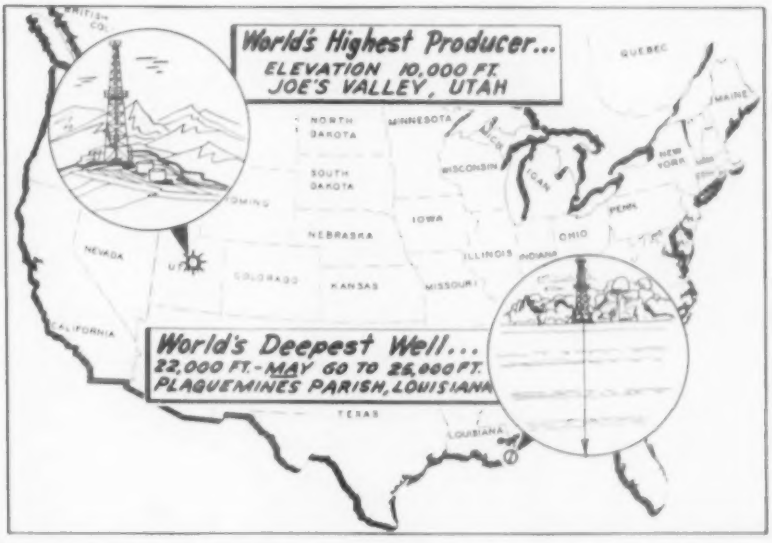
There's a size and type of International engine to fit your needs . . . from 16½ to over 200 hp.

INTERNATIONAL HARVESTER

INTERNATIONAL
INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

EXPLORATION



TWO NEW WORLD'S RECORDS were set during the past week. In Central Utah, Three States Natural Gas Co. ran production tests on the world's highest producing well at a surface elevation of 9,725 ft. In South Louisiana, Richardson & Bass continued to set new world's depth records at their wildcat, the 1 LL&E-Humble "L," now at 22,250 ft.

Records Fall at Top and Bottom of the U. S. Map

by Frank J. Gardner

IF you like to dabble in superlatives, here's a couple of the latest ones recorded by the oil industry. By coincidence, both emerged within the past week. Both have to do with footage.

High . . . In the rarefied atmosphere of Central Utah, Three States Natural Gas Co. announced successful tests on the world's highest producing well at a surface elevation of 9,725 ft. It's a new discovery, the 1-X Joes Valley, in Section 17-15s-6e in San Pete County. This is about 4 miles southwest of Three States' Clear Creek gas field on the Wasatch Plateau.

The well has been shut down now until spring, but gas flows of 15,000 M.c.f. have assured a strike of importance at Joes Valley. Production was from Ferron-Cretaceous sand at 7,090 ft., the same sand that yielded prolific gas flows at Clear Creek. The total depth of the well, at 7,262 ft., sits 2,463 ft. above sea level.

Low . . . Clear at the other end of the rainbow, Richardson & Bass continued to punch ahead in the world's deepest well. At this writing, they have carried the 1 LL&E-Humble "L," 35 miles southeast of New Orleans in Plaquemines Parish, to 22,250 ft. How deep the hole will eventually be is still anybody's guess, but the operators say that the absolute depth capacity of the rig and pipe is in excess of 25,000 ft. They're spending $8,000 a day for an average 30 ft. of new hole per day in this unprecedented drilling venture. Before it's flanged up, it will be a $2,000,000 hole.

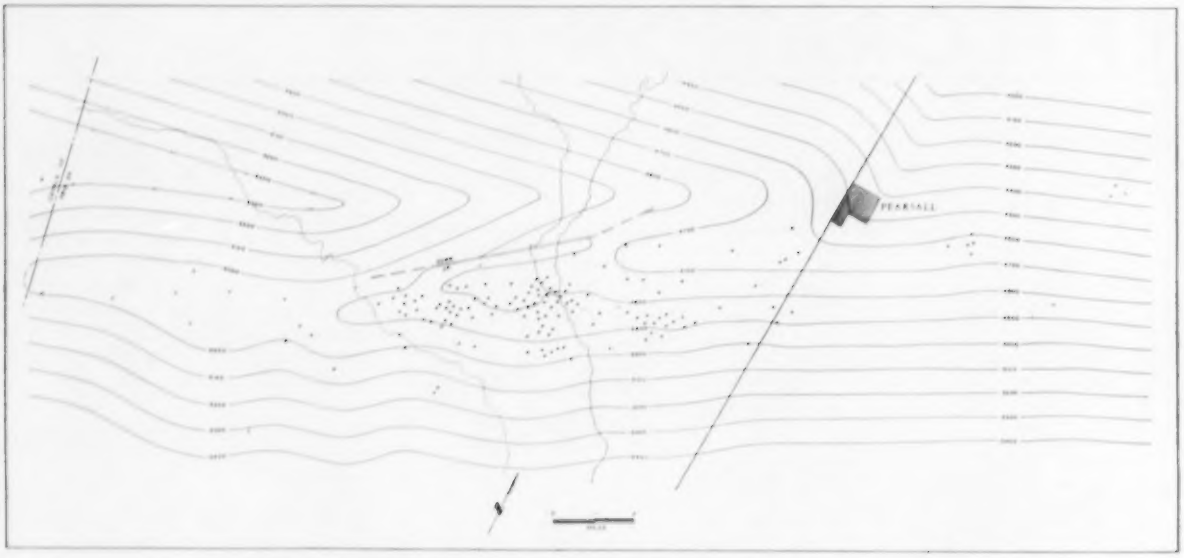
Records go . . . Drilling a well at an altitude of nearly 10,000 ft. is challenging enough, and Three States has made exploration history with the unusual operation. But the sinking of a 25,000-ft. hole is something the industry has anticipated for years, and the drilling in South Louisiana is making industrial history. This is the first time Louisiana has captured the world's depth record, though it has held the producing depth record off and on for years. This is the first time a drilling barge has held the depth record, and Rig 25 is acquiring a fame all its own. The deep wildcat may set a new world producing record as well, for at least four possible oil sands have been reported below 20,000 ft.

Guesses fly . . . Which brings us around to the old question: "How deep can we expect to find oil and gas?" Many theories and guesses have been advanced, some with valid laboratory experiments to support them. And at least one authority has calculated that oil could theoretically occur in sandstone to a depth of more than 65,000 ft., and in limestones to more than 51,000 ft. In 1948, in a more practical manner, Dorsey Hager* set a tentative limit on deep oil prospects. "In all of the deep basins and the Gulf Coastal area," he declared, "not over 10,000,000 acres lie below 20,000 ft. Much of this area carries productive fields above 15,000 ft. Considering that 1 acre in 100 of the deeper beds might produce oil, only 100,000 acres of oil territory are below 20,000 ft.—certainly a very small proportion, perhaps 2 to 3 per cent, of the great productive acreage of the United States."

Reserves are low . . . These observations, along with well-known facts and figures on the depth abode of oil we've found to date, certainly minimize the importance of "deep, deep" oil in any future reserves picture. Rather, if we are to find enough new oil to supply our needs in the last half of this century, we'd best look to new shallow sources and accent the lateral at the expense of the vertical in our search. The expenditure of $2,000,000 per well certainly does not appeal to the average independent operator, and he's the guy who is most likely to lead the search.

Richardson & Bass are independent operators; so are John Mecom and Freeport Sulphur Co., partners in the world's deepest well. But they are hardly what you'd call "average." To set up superlatives is an expensive hobby in this business, but whether they condemn or confirm our theories on sub-20,000-ft. oil pools, these operators will have served the industry well.

*The Oil and Gas Journal, January 8, 1948, page 64.

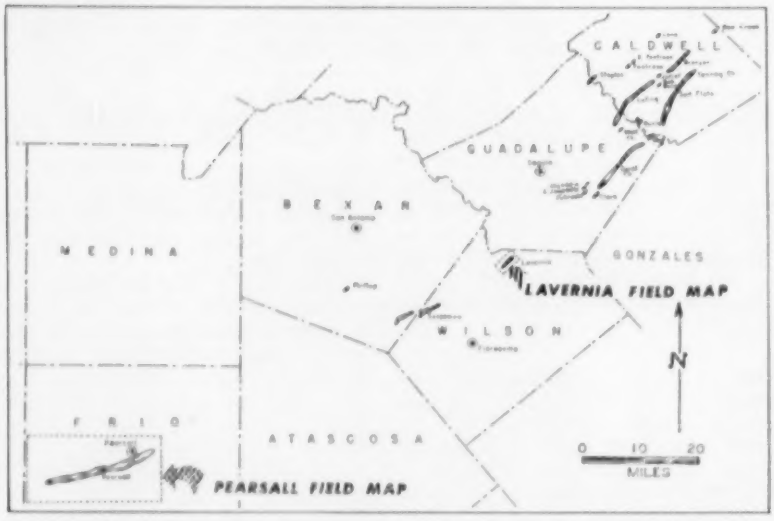


PEARSALL ANTICLINE in Frio County, Texas. Datum: top of the Austin chalk. Fig. 1.

Here's how South Texas operators are

Tapping the Austin Chalk's Rich Reserves

The Austin chalk formation in South Texas is typically a dense, impervious limestone. Production is dependent on secondary porosity and permeability by fractures. Oil is produced from the Austin chalk in two main trends: (1) on the crest and flanks of the Pearsall anticline; and (2) along the Luling-Mexia fault zone. The structure, stratigraphy, and reservoir characteristics of these two areas are briefly discussed in this paper.



AUSTIN CHALK OIL FIELDS of South Texas are scattered over a 20-mile-wide area. Fig. 2.

by William M. Doyle, Jr.

THE Austin chalk formation is developed in South Texas as a hard, dense, chalky limestone. It is predominantly impervious and contains very limited primary porosity. Oil production, therefore, must be associated with secondary porosity and permeability encountered in the form of joints, bedding planes, and fractures created by earth movements.

Fracture porosity has created production in two general areas of South Texas:

1. The Pearsall anticline area trending northeast-southwest across central Frio County.

2. The Luling-Mexia fault zone extending northeast-southwest through Caldwell, Guadalupe, Wilson, and Bexar counties.

The Pearsall Anticline

General . . . The Pearsall anticline (See Fig. 1) is located in Frio County, Tex., about 60 miles southwest of San Antonio. Present Austin-chalk production is scattered over an area 20 miles long by a maximum of 2½ miles wide. It

Author is with Midstates Oil Corp., San Antonio. This paper is presented by permission of the Gulf Coast Association of Geological Societies. It was given at the Association's fifth annual meeting in Biloxi, Miss.

comprises a total of about 30,000 acres.

Structure . . . This structure is a regional anticlinal fold. Originating in north-central Frio County as a gentle nosing, it increases in both depth and magnitude as it plunges to the southwest across western Frio County and into east-central Zavala County. The folding probably occurred in fairly recent geologic time; it is definitely post-Cretaceous in age.

Subsurface mapping on top of the chalk horizon indicates very little structural closure. The Pearsall anticline therefore does not cause production because of structural trapping, but rather because the upward arching of the beds has created fracturing in the Austin formation.

Reservoir characteristics and stratigraphy . . . The Austin chalk has an average thickness of 385 ft. and exhibits no appreciable thinning across the structure.

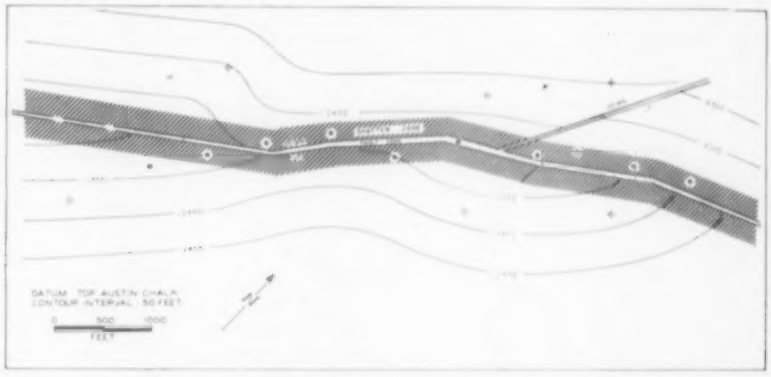
Chemical analysis indicates the Austin chalk typically to be 82 per cent calcium carbonate, 11 per cent silica and soluble silicates, 3 per cent ferric oxide and alumina, and 1 per cent magnesia. The Austin chalk lies unconformably on the Eagle Ford shale and is in turn overlain unconformably by the Taylor marl.

Core analyses of the chalk show it to have a natural porosity of 6-8 per cent and an average permeability of 0.0-0.4 mi. Diamond coring has shown that commercial production is found because fracturing has increased the porosity and created permeability in the chalk. These fractures appear to be chiefly hairline breaks, predominantly vertical, and running an echelon parallel to the axis of the fold. The lateral extent of the fractures is probably small.

Structural position has apparently little or no bearing on the type of production found. But as a general rule, fracture conditions have proven better near the crest of the anticline.

Oil accumulation is not in one simple homogeneous reservoir but rather is found in a complicated series of small traps within the large reservoir itself. These reservoirs are encountered both vertically down the well bore and laterally across the structure. Wells which penetrate the upper chalk section only produce 34° gravity oil, while those producing from the entire section recover 28° gravity oil on the average.

Production is believed to be of a gas-expansion-type drive. To date, no gas-oil or oil-water contacts have been established with the proven oil column now in excess of 1,200 ft. Occurrence of a well with a high gas-oil ratio or an abnormal amount of water production is uncommon and does not follow any fixed pattern.



HERE is a typical Austin Chalk "crevice" field—Lavernia.

Because of the irregularity of the fracturing, the drainage area of a well is impossible to determine. In one case, a prolific producer was offset 12 years after its completion and yet this offset well still had virgin bottom-hole pressures. In other cases, the completion of a well near other producers will immediately alter their production.

Completion practices and general information . . . Average total depth of these Austin chalk wells is 5,800 ft. Drilling requires an average of 25 days from spudding to completion.

Completions are open-hole. The usual method now employed by operators in this area is to drill 10 to 15 ft. into the chalk using drilling mud with a weight of about 10 lb. At this point, casing is set (5½-in. or 7-in. o.d.) and the mud is displaced with native oil. The chalk section is then drilled with a diamond bit.

The use of oil as the drilling fluid prevents the plugging off of the fractures present. Most wells complete in the entire 385-ft. section. However, when a well encounters sufficient fractures in the upper portion of the chalk, it is bottomed at a lesser depth. Some of the best producers are completed in only the upper 30 to 100 ft. of the section.

In the initial development of the field, both shooting and acidization were employed in the completion of wells. Shooting is now considered impractical due to its low beneficial effect and the high cost of cleaning out the well bore after the explosive is used. Most wells are now acidized, with the presently accepted treatment ranging from 3,000 to 5,000 gal.

A recent innovation in chalk completions of this area, and apparently an important one, is the use of artificial fracturing, either with a sand-oil gel or a sand-acid treatment. This type treatment raises the initial production just as acidization does. In addition it appears to maintain this increase at a higher level for a longer period of time.

Both slant drilling and the drilling

TYPE SECTION from Lavernia field.

TYPE SECTION from Pearsall field.

of angular drain holes off the main well bore have had limited trial in this area. Either of these methods should increase the quality of production since more vertical fractures would be intersected.

Most wells come in flowing. But usually, after a short period of flow, they have to be put on the pump.

Reserves . . . No reliable reserve estimate can be made because of the many variables encountered in a fracture-controlled limestone reservoir such as this. A rough estimate has been made, however, using the productive history of the older chalk wells as a base. This estimated ultimate recovery for wells on 40-acre spacing is computed to be between 100,000 and 125,000 bbl. of oil. It must be pointed out that this is an average. Since some wells are considerably better and others are very poor, quite a few wells must be drilled in order to anticipate this figure.

Production and development . . . The current Texas Railroad Commission allowable for the Austin chalk at this depth is 164 bbl. of oil per day, exempt from shutdown. Development is on 40-acre spacing. Since the discovery of Pearsall Austin chalk production in 1935, a total of 116 oil wells and 10 dry holes have been drilled. Accumulative production to January 1, 1955, is 4,054,483 bbl. of oil. Currently 103 wells are producing 43,486 bbl. of oil per month for an average of 422 bbl. per well per month. This current average per well is substantially lowered by the inclusion of many wells, 10 or more years old, now nearing depletion.

Luling-Mexia Fault-Line Trend

General . . . Austin chalk production is found along the Luling-Mexia fault-line trend through Caldwell, Guadalupe, Wilson, and Bexar Counties. The trend, famous for its prolific Edwards line production, strikes northeast-southwest and covers a total distance of more than 70 miles.

The chalk is currently productive or has produced at Bee Creek, Bob Rose, Dunlap, Fentress, Fentress East, Joliet, Lane, Salt Flats, and Tenney Creek fields of Caldwell County; Staples and Luling-Branyon fields in Caldwell and Guadalupe Counties; Clark, Darst Creek, Day, Jayeddie, Jayeddie South, United, Wolf Creek, and Zoboroski fields in Guadalupe County; LaVernia field in Wilson County; Saspamco field in Wilson and Bexar Counties; and Philtop field in Bexar County.

Structure . . . Accumulation of oil in the Austin formation is associated with structural closures against the upthrown side of normal, up-to-the-southeast faults. Throws vary from a few feet to several hundred. These faults generally strike between N. 30° E. and N. 60° E. with a hade ranging from 30° to 45°. Normal dip of the beds is southeasterly at 100 to 150 ft. per mile.

Stratigraphy and reservoir characteristics . . . Production is found at depths from 200 to 3,000 ft. The chalk formation ranges in thickness from 120 ft. to 350 ft.

Core analyses show the porosity to average between 4 and 25 per cent, but with permeability of 0.0 to 0.5 md. Oil saturations by pore space run as high as 40 per cent. The faulting, then, not only forms the structural trap for accumulation but also creates by fracturing the necessary permeability for production.

In order to be productive, a well must penetrate the shatter zone located at and near the intersection of the fault plane and the Austin chalk. Because of this, chalk wells in this trend are usually referred to as "crevice" wells. The fractured zone is located on both the upthrown and downthrown side of the faults and production is therefore found on both sides of the faults. It is assumed that downthrown wells are producing from fractures which extend across and establish communication with the upthrown reservoir.

A well which cuts the fault in the chalk section itself or within a zone of 100 or 200 ft. on either side usually encounters enough fracturing to come in naturally. If not, it requires only a light acid treatment to clean out the well bore. A well penetrating the chalk outside of this highly shattered zone must break into it by using either a comparatively large acid treatment or by artificial fracturing.

Recently, in a few areas not directly associated with faulting but where the natural porosity of the chalk is higher than average and structural closure exists, operators have been creating production by employing large "frac" treatments and thereby inducing permeability. Even in these cases, there is undoubtedly some natural fracturing aiding production.

Oil from the Austin chalk is a sour sulfur crude with gravities from 23° in the shallower fields to 39° downdip.

Production is probably of a combination gas-expansion and limited-water-drive type. Since the extent of communication varies greatly between wells, it is usually impossible to establish definite contacts. Water encroachment usually begins in older wells first, regardless of structural position. Commonly, older wells at or near the top of a structure will make considerable water while younger wells much lower structurally produce no water. As a well nears depletion, the percentage of water produced with the oil increases steadily. But in limited cases a well will pump completely dry making neither oil nor water.

Completion practices and general information . . . Although minor production is found shallower, the average depth of the Austin chalk producers is between 2,000 and 3,000 ft. Drilling time usually takes 4 to 6 days below surface.

Completions are made in open hole and through perforations. Some operators prefer to diamond core the chalk section, set casing through it, and selectively perforate the more shattered and saturated zones.

Another method commonly employed is (1) simply to drill into the chalk section until loss of circulation indicates enough fracturing to produce, and (2) then run an electric log. If the structural position and relationship to the faulting is considered favorable, casing is set and completion attempted, usually open-hole.

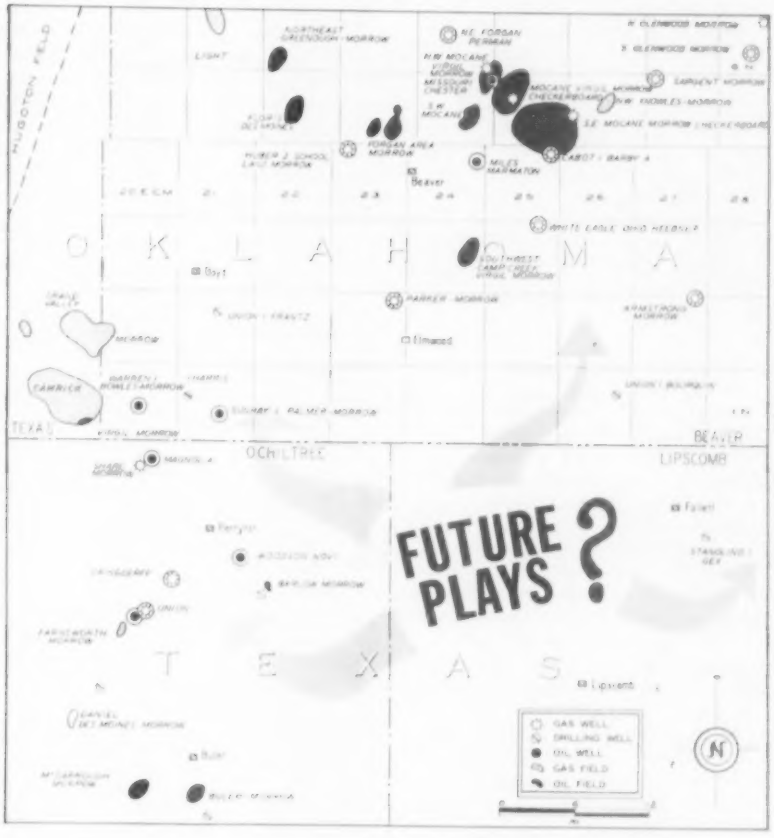
Early wells in a field normally come in flowing. At pressure declines, these wells are put on pump and later wells drilled must be initially completed on pump.

Reserves . . . Known past productive history of Austin chalk "crevice" wells are the only guide in estimating reserves. A very general ultimate recovery figure has been set at 50,000 bbl. of oil per well. Some "crevice" wells have made more than 200,000 bbl. while others make only a few thousand. Nevertheless, a well situated properly with respect to structure and the faulting and properly produced can be relied on not only to reach the 50,000 bbl. mark but to exceed it substantially. The well density naturally is a major factor in estimating the ultimate recovery per well.

Allowables for Austin chalk wells averages from 30 to 80 bbl. per day, exempt from shutdown. Development is usually on 10 or 20-acre proration units.

Conclusion

Development up to present has proven that the Austin chalk holds a tremendous reserve of oil, still largely untapped. Methods of efficiently recovering this reserve have made remarkable progress in the last few years. As these completion methods become increasingly efficient and as the more predictable and lucrative production from the various sand trends in South Texas is exhausted, more and more attention will turn toward the Austin chalk formation.



The four arrows point to directions of fresh promise as

Hugoton Embayment Play Extends Through Three Counties

John C. McCaslin

A BUSY exploratory and development year in the Hugoton embayment of the western Anadarko basin has resulted in four new avenues of exploratory promise . . . southeastern and southwestern Beaver County in the Oklahoma Panhandle, and Ochiltree and Lipscomb counties in the Texas Panhandle.

Beaver County . . . Fifteen discoveries in this Oklahoma county make this the most successful area in the region. Operators established new producing areas in two widely separated portions of the county . . . in the southeast and southwest. Both these areas have had little previous drilling. New pays, new fields, and extensions in and around the Mocane area of Beaver County upped the potentialities of this new reservoir considerably.

. . . Southeast. Union Oil Co. 1 Parker, C NW SE 11-2n-23eCM, is possibly the most important discovery of the year in the Oklahoma Panhandle. This well flowed 28,250 M.c.f. of gas daily plus 75 bbl. of distillate from the Morrow-Pennsylvanian sand.

Another southeastern discovery for the county is Colorado Oil & Gas Co. 1-3 Armstrong in C SW SW 3-2n-27eCM. This well flowed 10 bbl. of distillate and 1,629 M.c.f. of gas from the Morrow at 7,688-7,706 ft. Union is now opening another pool in the far southeastern corner of the county at 1 Bourquin in 1n-26eCM.

. . . Southwest. The latest Beaver County area to come into exploratory prominence is the southwestern corner, immediately east of prolific Camrick field.

Warren Petroleum Corp. 1 Bowles, SE SE NW 22-1n-20eCM, flowed 15 bbl. of oil per hour on 2-in. tubing from the Morrow sand. Sunray Mid-Continent Oil Co. has another Morrow oil pool in the making in NE NE SW 28-1n-21eCM. Warren is drilling another prospect at 1 Harris in C SE NE 19-1n-21eCM. Union will drill a 7,600-ft. wildcat at 1 Frantz in SW NE 10-2n-21eCM, in a relatively untested area of the county, 10 miles northeast of Grand Valley field.

. . . Mocane area. This big producing area has grown by leaps and bounds this year. There are now four Mocane fields: Northwest, Southeast, Southwest, and Mocane itself.

The most recent exploratory success here is United Producing Co.'s Chester-Mississippian lime discovery in Northwest Mocane field. The 5 Adams, C SW NE 36-6n-24eCM, flowed 494 bbl. of oil daily from perforations at 6,228-38 ft. Other pays in the field include Virgil, Morrow, and Missouri, all Pennsylvanian.

. . . Other Beaver hits. White Eagle Oil Co.-Ohio Oil Co. 1 Jewett & Bennett, C SW NE 2-3n-25eCM, flowed 628 M.c.f. of gas daily from the Heebner at 5,050-96 ft. to open a small Pennsylvanian gas pool.

J. M. Huber Corp. 2 School Land, C NW NE 4-4n-23eCM, flowed 2,130 M.c.f. of gas per day from the Morrow to open a new gas area in the Forgan area. Cities Service Oil Co. 1 Miles "B," SE SE NW 12-4n-24eCM, pumped 60 bbl. of oil daily from the Marmaton-Des Moines-Pennsylvanian, opening Miles pool. Cabot Carbon Corp. 1 Barby "A," C NW NW 1-4n-25eCM, is a gas discovery in the Southeast Mocane area, extending that field south.

The discovery wells in the Northwest Mocane area are: Cabot 1 Judy and 1 Hodges in C NE SW 1-5n-24eCM and C SW NE 1-5n-24eCM, respectively. The Judy well got Morrow gas and the Hodges Checkerboard oil (846 bbl. per day).

Carter Oil Co. 1 State-Richards in SE SE NW 16-5n-25eCM, in the Mocane area, flowed gas and distillate from the Chester-Mississippian. Southeast Mocane had an extension discovery at

United Producing Co. 1 Barby in C SE NW 34-5n-26eCM. That Morrow well flowed 3,020 M.c.f. of gas per day. The Texas Co. 1 Sargent "A" in C SE NW 7-5n-27eCM, opened Sargent-Morrow gas field.

Lion Oil Co. 1 Hodges in C SW NE 21-6n-24eCM, made 4,500 M.c.f. of gas per day from the Council Groves-Permian to open the first "outside Hugoton" Permian gas area in the Oklahoma Panhandle.

O. H. Parker 1 Hennigh, C NW NW 28-6n-28eCM, is a gas-distillate discovery in the South Glenwood area of the northeastern corner of the county.

Ochiltree County . . . Texas Panhandle exploratory interest has shifted from Hansford County to Ochiltree.

One of the best discoveries in this area is Woodson Oil Co.'s 1-A Perry Unit, a Seven Fingers lime and Morrow sand discovery. The dual discovery flowed 4,000 M.c.f. of gas per day and 330 bbl. of oil from the two pays. The discovery opened Novi field. Woodson has another wildcat under way 4 miles southeast of Perryton and 2 miles southeast of the 1-A Perry Unit discovery well. Projected depth is 8,500 ft.

Union Oil Co. of California 1 Russell, west-central Ochiltree, is another Morrow gas discovery, 5 miles south of Farnsworth and 2½ miles northeast of Farnsworth-Morrow gas field (1 well). Union recently completed 1 Buckhaylts as a Morrow oil discovery 1¼ miles northeast of Farnsworth field.

Magnolia Petroleum Co. is drilling a test 16 miles southwest of Perryton in southwestern Ochiltree, 8 miles northeast of production. M. A. Machris will go to 9,000 ft. at another test 25 miles south of Perryton in south-central Ochiltree County. Superior Oil Co. has a Morrow gas discovery at 1 Oringderff, 5 miles southwest of Perryton. That well flowed 11,500 M.c.f. of gas daily. It lies 8 miles northeast of Farnsworth field.

Lipscomb . . . Stanolind Oil & Gas Co. is drilling a wildcat in the northeast corner of this county that is being watched with intense interest.

The 1 Gex, a 9,600-ft. wildcat, is 6½ miles southeast of Follett, about 20 miles south of the Mocane area of Oklahoma. Closest Texas production is in the Perryton area, 30 miles to the west.

Lipscomb and Ochiltree should be the most active exploratory areas in the Texas Panhandle in the coming months. Lipscomb has had little previous drilling and there is no production.

APPALACHIAN

OHIO

A shallow gas pool may have been opened in Hopewell Township, Perry County, by C. M. Foraker et al wildcat on 1 Edith Kelly, Section 9. The test was started for the Clinton sand, but 710,000 cu. ft. of gas was encountered in the Berea sand at 715-38 ft. and it was turned into the line.

● Operators in the old Union Furnace field are making unusually good producers by fracturing the sand in an area thought to be economically de-

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THE OIL AND GAS JOURNAL

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DALLAS

OFFICES IN PRINCIPAL OIL AREAS

pleted. Oldfield Oil 1 (4) R. C. Bremmer, Section 4, Washington Township, Hocking County, gaged 80 bbl. in 24 hours with 600,000 cu. ft. gas from Clinton at 2,895-2,913 ft. In the same township, the Diamond Oil 2 (5) Section 12, gaged 300 bbl. in 24 hours with 500,000 cu. ft. gas from Clinton at 2,982-3,007 ft.

● Bumgard and Coury's 1 O. Fink, Section 6, Hopewell Township, Muskingum County, an extension to Cottage Hill pool, logged the Clinton at 3,258-86 ft. with a gage of 350 bbl. in a 24-hour test after fracture.

WEST VIRGINIA

In Dry Fork district, Randolph County, West Virginia, Columbian Carbon Co. announced final completion of 1-1208 D. Hill Arnold, wildcat, elevation 3,155 ft. First reported completed at a depth of 4,846 ft., it had an initial open flow of 697,000 cu. ft. of gas in the Oriskany sand. In deepening operations the final flow is 9,832,000 cu. ft., with a rock pressure of 2,045 psi. in 144 hours. Hope Natural Gas Co. 9957 U.S.A., Department of the Interior, is drilling at 582 ft.

● Glade district, Webster County, Nelson W. Taylor, Agent, has announced 1 Victoria Riddle, wildcat, elevation 2,305 ft., Cowen Quadrangle, 5.36 miles south of latitude 38 degrees 30 minutes and 2.30 miles west of longitude 80 degrees 35 minutes.

PENNSYLVANIA

Banks Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co. 1831 Farmers & Miners Trust Co. shut down at a depth of 670 ft.

● In Young Township, Manufacturers Light & Heat Co. 4336 Stewart & R. & P. Coal Co. encountered a fishing job at 188 ft.

WESTERN CANADA

ALBERTA

Corbett Creek Area Wildcat Finds Good Oil Showings

A wildcat, wholly owned by Mobil Oil of Canada, Ltd., and located in the Corbett Creek region of west-central Alberta, has yielded encouring oil shows in the top portion of the Viking sand during initial tests. Further tests are under way to determine the well's potential.

This well, 25-5 Corbett Creek, LSD 5, 25-61-8w5, made 11.1 bbl. of oil during a 1½-hour swab test in the top of the Viking sand. It is about 75 miles northwest of Edmonton.

D1 Devonian Gas Found At Baptiste Area Wildcat

British-American Oil Co.'s wildcat in the Baptiste area, 12 miles southwest of Athabasca and 75 miles north of Edmonton, has discovered gas in the D1 zone of the Devonian, and also has a good gas show in the Viking sand.

The well, British - American - Cal-Standard 10-33 Baptiste Lake, LSD 10, 33-65-24w4, flowed 3,870 M.c.f. of gas per day from the D1 over a 35-ft. interval; it made 1,630 M.c.f. per day from the Viking.

ROCKY MOUNTAIN

COLORADO

Discovery Indicated at Weld County Wildcat

Hallbert & Jennings and Dan Rounds Drilling Co. 1 Chapel, C NE NE 17-9n-56w, Weld County wildcat, recovered oil from the "D" sand and gas from the "J" sand.

Recovery included lift of saturation in the "D" sand on a core at 5,765-85 ft. A test of this interval got 1,475 ft. of oil. On a drill-stem test in the "J" sand at 5,856-66 ft. gas flowed at the estimated rate of 5,000 M.c.f. per day. Pipe recovery was 75 ft. of distillate.

This discovery is 2 miles northeast of Stoneham gas and oil field. That field has "J" sand gas and D sand oil production.

Shinarump Discovery at Routt County Prospect

English Oil Co.-Panhandle Oil Co. recovered 430 ft. of gassy, brown oil on a test of the Shinarump at 1 Long in the Sage Creek area of Routt County.

The well, located in NE NE SE 7-4n-87w, recovered 360 ft. of heavily oil-cut mud on test at 3,725-52 ft. Top of the Shinarump is 3,715 ft. The sand is at 3,725 ft. This indicated discovery is 10 miles southwest of Tow Creek field production, and 22 miles southeast of Hayden.

WYOMING

Shannon Extends Production At Alkali Butte Well

Shannon Oil Co. 3 Government, N½ NE NE 12-33n-95w, Fremont County, recovered gas at the rate of 10,000 M.c.f. per day on a drill-stem test of the Morrison at 4,148-81 ft.

Smaller gas recoveries were reported on Dakota-Lakota zone tests. The well is on the Mount Rogers Unit. Location is ½ mile southeast of the Alkali Butte discovery made by The Texas Co.

NORTH DAKOTA

Casing Set at Renville County Confirmation Test

Production string is set at 1 Ritter "B," NW NW 23-163n-86w, confirmation try to Sohio Petroleum Co.'s Bluell field discovery well.

Total depth is 4,650 ft., pipe is at 4,570 ft. Recovery was 450 ft. of free oil on a drill-stem test at 4,479-98 ft. and 180 ft. free oil at 4,507-17 ft. This well is the offset to the Bluell field discovery well which was completed as a Madison oil discovery for 274 bbl. per day. The discovery is one of the exploratory highlights of the entire Rocky Mountain province for 1955.

Williams County Extension Well Flows 24 BOPH on Test

Amerada Petroleum Corp. reported a flow of 24 bbl. per hour on drill-stem test at the 1 Halvorson, NW SE 32-155n-95w, Williams County extension well to Wolff field.

Flow during the second hour of the test was 21 bbl. with pipe recovery 1,080 ft. of oil. This well is located between Capa and Hoffland pools on the Nesson anticline. The well extends production opened at the 1 Wolff Estate in NW NE 5-154n-95w. That well was finaled earlier this year for 44 bbl. of oil and 29 bbl. of water on pump.

NEBRASKA

Rework Job Due at Hitchcock County Well

Jones, Shelburne & Farmer are moving in cable tools to rework 1 Fritz, Hitchcock County Pennsylvanian discovery in NW NW SE 35-3n-31w.

Production has been through perforations at 3,881-86 ft. Recent pump tests recovered only 12 bbl. of oil per day with 28 per cent water. Pump failure shut the well down. The discovery opens a possible second pool for the Cambridge arch.

HUGOTON EMBAYMENT

TEXAS PANHANDLE

Rank Hansford Discovery Flows Morrow Sand Oil

R. H. Fulton 1-144 Bena Jones, probably one of the most significant

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discoveries in the Hansford County play this year, flowed 576 bbl. of oil per day on ½-in. choke from perforations in the Morrow sand at 6,987-7,002 ft.

The new pool-opener is located in the NE¼ of Section 144, Block 45, H&TC Survey, 16 miles from nearest oil production. The new well is 5 miles south of Gruver and 4 miles southwest of gas production in Gruver field.

OKLAHOMA PANHANDLE

Distillate Gage Run at Beaver County Discovery

Sunray Mid-Continent Oil Co. is running final tests at its Beaver County discovery well, the 1 Palmer, NE NE SW 28-1n-21eCM.

The well gaged 92 bbl. of distillate and 52 bbl. of distillate in 24 hours on 30/64-in. choke. Gas volume was 3,500 M.c.f. per day. The well is producing from perforations at 8,042-62 ft. in the Morrow sand.

SOUTHWEST KANSAS

High Gas Volume Tested At Comanche County Well

Pure Oil Co. 1 Hazel Beals, C NE NW 5-34s-17w, 18 miles southwest of Robbins Ranch pool in Comanche County, tested the Simpson sand at 5,620-5,720 ft. Gas flowed at the rate of 3,950 M.c.f. per day. Recovery was 35 ft. of distillate. The volume later increased to 9,980 M.c.f. per day.

Previously, the well flowed 5,594 M.c.f. per day from the Kansas City lime and 207 M.c.f. from the Mississippian. Robbins Ranch is the only producing area in Comanche County. The discovery lies on an indicated Simpson trend that extends southeast to Yellowstone and Farris pools in Woods County, Oklahoma.

Pure Oil Co. 1 Hazel, C NE NW 5-34s-17w, Comanche County, is an indicated Kansas City-Pennsylvanian gas discovery, 18 miles southwest of Robbins Ranch field, the county's only other producing area.

MID-CONTINENT

NORTH TEXAS

Cambrian Strike Completed In Stonewall County

American Liberty Oil Co. 2 Shadle was still classified as a Cambrian sand discovery at completion gage, turning a daily flowing potential of 264 bbl. of oil through 9/64-in. choke. There was no formation water, and flowing tubing pressure was 660 psi. Gas-oil ratio was relatively low at 190:1, but gravity was 42.9°.

At this writing there was some difference of opinion as to the pay zone, either upper Cambrian or Ellenburger. Operators reported the Ellenburger missing, which has been the case with other Cambrian fields to the south of this strike; with the well going into the Cambrian section at 6,108 ft. The conglomerate section, productive in wells a half mile or so to the north, also was missing.

Nearest comparable production is in White Flat field, northeastern Nolan County, about 50 miles to the south of 2 Shadle. Location of the well is in 134-D-H&TC Survey, 2 miles north of Aspermont.

Nolan County . . . C. L. Norsworthy, Jr., and Foree Drilling Co. 1 Compton, 2 miles southwest of Nenia-Strawn field, has flowed oil on two drill-stem tests. In limestone, not identified, at 6,970-88 ft., gas surfaced in 3 minutes and oil in 1 hour and 35 minutes.

On second test, at 6,988-7,025 ft., oil surfaced in 1 hour and 25 minutes and was allowed to flow into pits, making an estimated 18 bbl. an hour. Drilling continued below 7,325 ft.

Jones County . . . Lester & Duffield, Inc., and Brazier-Staley 1-B Phillips, wildcat 9 miles west of Anson, was showing for a Swastika sand discovery.

On test at 3,216-28 ft., open 3 hours, recovery was 400 ft. of oil and 100 ft. of oil and gas-cut mud. Flowing pressure reached 150 psi. A test at 3,213-38 ft., open 3 hours, recovered 90 ft. of free oil and 270 ft. of heavily oil-cut mud. Plans were to drill ahead to the lower Swastika before setting pipe.

KANSAS

Kinderhook Discovery Seen for Edwards County

F. Kirk Johnson 1 Wood, NE NE NE, 26-26s-16w, is an indicated Kinderhook - Mississippian discovery in southeastern Edwards County.

The well, located 4 miles west of Tatlock pool, gaged 132 M.c.f. of gas per day and recovered 1,125 ft. of clean oil, 150 ft. oily water and 240 ft. clean water on drill-stem test at 4,510-35 ft. The wildcat is 4 miles southeast of Trousdale, Kansas.

Chautauqua County Test Shows Mississippian Oil

Casing is set at a Mississippian oil discovery in central Chautauqua County, southeastern Kansas. Orville Parker 1 Leniton, NE NE NE 7-33s-10e, 1 mile north and 1 mile west of Leniton pool, recovered 6 ft. free oil and 50 ft. oil-cut mud on a drill-stem test at 2,090-2,100 ft. The east offset has been

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staked at 1 Leniton, NW NW NW 8-33s-10e.

Lansing Discovery Reported In Southern Barton County

Hilton Drilling Co. has a Lansing discovery at 1 Case in NW SW SW 5-19s-14w, 1 mile northwest of Richardson pool.

Recovery on a drill-stem test at 3,264-85 ft. was 1,800 ft. of gas-cut mud, 60 ft. muddy oil and 60 ft. oil. Another test at 3,344-96 ft. got 540 ft. of gas and 80 ft. oil-cut mud. A Lansing test at 3,402-30 ft. recovered 15 ft. mud and a trace of oil. Location is ½ mile west of Heizer, Kans.

EASTERN INTERIOR

ILLINOIS

Oil production appears to have moved to the very brink of the Illinois basin in Union County.

Rank Discovery Reported At Basin's Extreme End

A rank wildcat more than 40 miles from production in Illinois is reported at F. L. Rigney 1 Hileman, NWc NE SW 21-13s-1w, Union County. Testing in the Hardin-Mississippian sand recovered load oil in 2 hours. The operator then bailed 10 bbl. per hour.

This wildcat is located in the south tip of the state at the very brink of the Illinois basin. Location is southeast of Jonesboro.

• In Clinton County, Hamil Oil Co. is putting on pump its 1-B W. M. Wortman, S½ NW SE 27-3n-1w, 9 miles northwest of Centralia. The well flowed 10 bbl. of oil per hour natural on ⅛-in. choke from the Devonian at 2,850-55 ft. Nearest production is 2 miles.

• Delbert Runyon and Dr. Kenneth Taylor 1 Coggan, SE SW SW 17-4n-8e, pumped 91 bbl. of oil per day on completion from the Rosiclare lime at 2,994-3,001 ft. The discovery is 1 mile north of Sailor Springs and 2 miles from production.

• Athene Development Co. 1 Jennings, SE NE NE 16-4n-10e, 4 miles north of Olney in Richland County, recovered 1,000 ft. clean oil on a drill-stem test at 3,011-17 ft. Completion work is under way.

ARK-LA-TEX

ARKANSAS

Cotton Valley Well Flows Oil in Snow Hill Area

Don H. Peaker et al 1 Reynolds and Berg, 28-15s-15w, Snow Hill area of Smackover field in southern Ouachita County, flowed 270 bbl. of oil from the Cotton Valley at 3,363-67 ft. Gravity is 35°.

The well opens first such production in the Snow Hill area on the north side of Smackover field. Nearest Cotton Valley production is 8 miles southwest on the southwest flank area of the Smackover field. That well is Placid Oil Co. 1 Epps, C SW NE 21-16s-16w.

1956 S.E.G. Convention to Be Held in New Orleans

The 1956 national convention of the Society of Exploration Geophysicists will take place in New Orleans next October 29 through November 1, and Kenneth R. Wells, vice president of General Geophysical Co., has accepted the position of general chairman.

Kenneth R. Wells, vice president of General Geophysical Co., has accepted the position of general chairman for the S.E.G. 1956 convention.

The S.E.G. is looking forward to next year's convention as one of the most important in its 26-year history, because 1956 is International Geophysical Year. Therefore, the New Orleans session is expected to have world wide significance, and an attendance of about 2,000 persons is anticipated.

PACIFIC COAST

CALIFORNIA

Shell Extends Vedder Production

Shell Oil Co. extended its deep Vedder zone production in the Posuncula area of Strand field, Kern County, with the completion of 131-12 Posuncula KCL ¼ of a mile west of the discovery well. This latest completion was brought in flowing 667 bbl. daily of 14.7°-gravity crude through a 20/64-in. choke from the perforated intervals 12,362-88 ft. and 12,388-93 ft. This extension is located NW NE 12-30s-25e. Shell was coring on 144-1 Posuncula KCL at 12,402 ft. This is located ¼ mile north of the Vedder discovery.

Monterey Drilling Ahead On Tidelands Lease

Monterey Oil Co. was drilling ahead at 8,171 ft. on 1 State 1549, the first test of a 1,280 acre tidelands lease offshore from West Newport Beach in Orange County. Monterey is acting as operator on the parcel which was awarded to Monterey, Humble Oil & Refining Co. and Seaboard Oil Corp. in the state's first cash bonus bidding for tidelands leases last August . This combine won two 1,280 acre leases at that time for a total bonus bid of $4,667,066. The parcel now under exploration by Monterey extends 1 mile seaward from the shoreline.

Drilling Activity Drops In Central California

Drilling activity in San Joaquin and Sacramento valleys has dropped off to the point where only about 50 per cent of the contract rigs available in that area are working. Wildcatting was keeping six rigs operating in the gas fields of the Sacramento area while 14 were engaged in exploration in Kings, Kern, San Joaquin and Fresno counties.

Part of the slack can be pinned to the usual year-end tailing off with the lack of recent discoveries contributing the balance of the blame. Of the approximately 80 rigs available in the

central California oil areas, only about 50 were on jobs and 16 of these were engaged outside the valley.

GREAT LAKES

MICHIGAN

Spectacular results have been reported from a sand fracturing treatment to a Dundee oil pay in Birch Run field, Birch Run Township, Saginaw County. A new well, which showed for about 3 bbl. of oil natural in 36 hours, was boosted to a high of 100 bbl. of net oil in 4 hours flowing after this treatment. Well will be restricted to about 50 or 60 bbl. of oil daily.

This new producer was the John V. Wicklund, Jr. 1 Frost, E½ SW NE 20-10n-6e, the west 10-acre offset to second Dundee oil well completion in the field, and the second 10-acre well west of the discovery producer in the Dundee. The 1 Frost was fractured with 15,000 gal. of oil and 30,000 lb. of sand. On first full day of net oil recovery, well flowed 42 bbl. in 50 minutes; a total of 100 bbl. in 5½ hours. The following day, in 4 hours, well flowed 100 bbl. of oil. Well was killed with water to pull tubing and remove tubing packer used in fracturing treatment. After tubing had been rerun and water had been swabbed from hole, well kicked off and flowed 90 bbl. of oil in 3½ hours through tubing.

The 1 Frost logged Dundee top at 2,514 ft. Pays showed at 2,532-46 ft.; 2,556-66 ft.; and at 2,583-2,603 ft. Well carried a little more oil and gas natural than did 2 previously completed producers on the Morse discovery lease, although it was but 1 ft. higher structurally. Performance after fracturing treatment was far better than at the 2 previous completions.

● Carter Oil Co. 1 Allers, SW SW SW 4-14n-14w, Denver Township, Newyago County, east 20-acre offset, and first follow-up completion to the new Huber Traverse pool discovery well, flowed 49 bbl. of oil natural in 2 hours through a ¾-in. choke from perforated pay at 2,103-11 ft. Well was restricted to 100 bbl. of oil a day after this test.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Two Wildcats Showing as Fusselman Discoveries

A good flowing well in Upton County, and another in Crockett County swabbing oil, were seen as new Fusselman discoveries.

The flowing well is Humble Oil &

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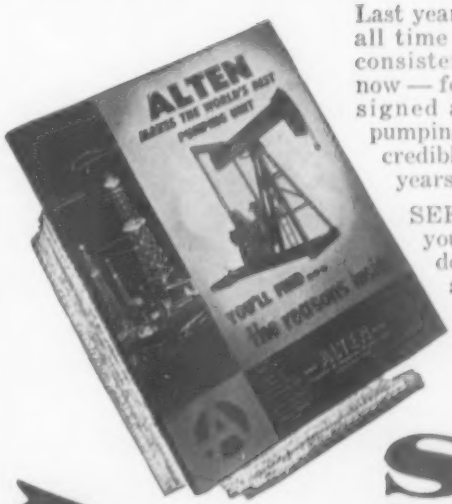

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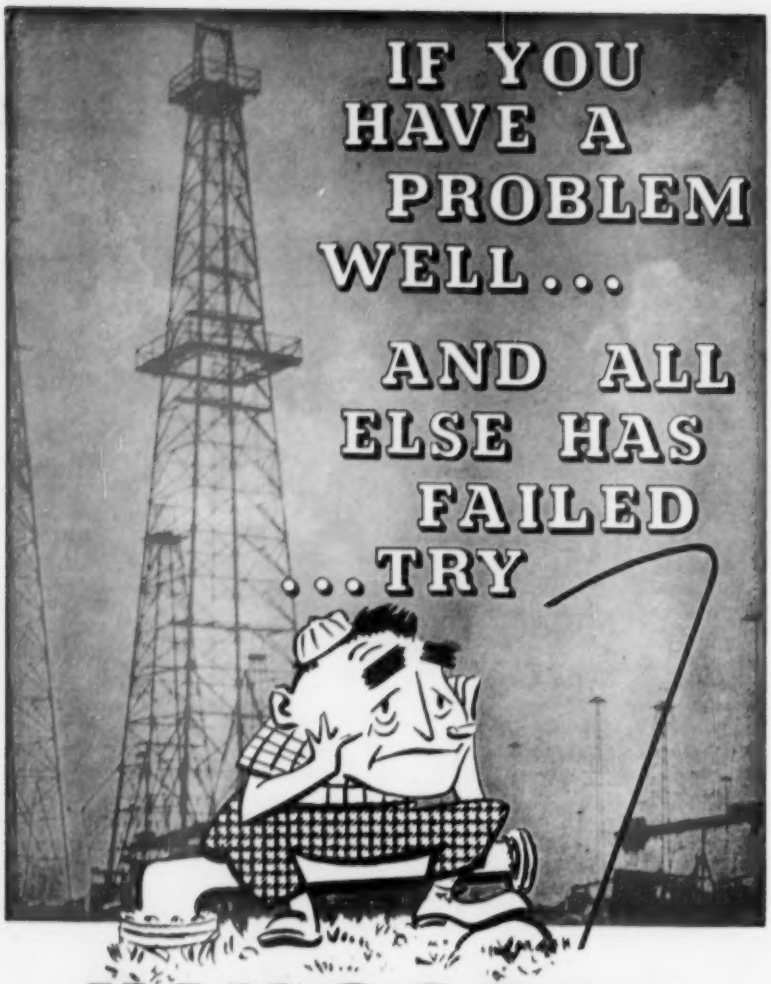

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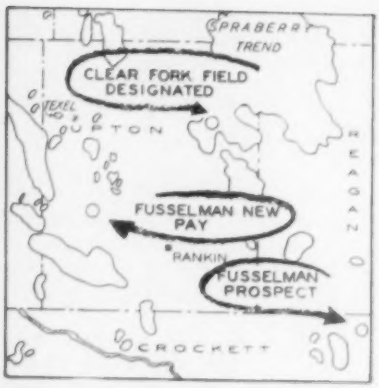

Clear Fork recompletions have created considerable activity in the Spraberry Trend fields, with two areas named by Texas Railroad Commission. These are Clear Fork West, and Clear Fork South, located in the area shown on map. In King Mountain field, Humble has opened Fusselman production at 2-D Barnett; northeast of Wor'd field, Texas Pacific test is swabbing Fusselman oil.

Refining Co. 2-D Barnett, which opened a new pay zone, plus a northeast extension, in the King Mountain-Ellenburger field. The first Fusselman flow reported was on test at 10,510-10,606 ft. Gas surfaced in 12 minutes and oil in 25, to tank 34.9 bbl. in 30 minutes. Choke sizes and pressures were not disclosed.

A second test over the same interval, using 1 and ¾-in. chokes, had flowing oil in 24 minutes. It cleaned into pits for 10 minutes, then was turned to tanks for 2 hours, making 104.81 bbl. of 54.8° oil. Flowing pressure was 1,725 psi., and shut-in pressure 3,375 psi. in 30 minutes. Operators drilled ahead on an Ellenburger contract.

This well also indicated production from the Devonian at 10,375-10,499 ft., where it recovered 500 ft. of free oil. Humble's field opener flowed oil from the Devonian at 10,509-52 ft., and recovered clean oil on two tests of the Fusselman, but drilled on to complete in the Ellenburger.

Crockett County prospect . . . Texas Pacific Coal & Oil Co. 1-M University, wildcat 12 miles southwest of Big Lake, was swabbing oil from the Fusselman at last report.

After acidizing through perforations at 9,600-65 ft., swabbing recovered load oil and 40 bbl. of new oil in 10 hours. Total depth was 10,275 ft., plugged back to 7,500 ft. Location is about 3 miles northeast of World field.

In the West World Strawn area, Cities Service Oil Co. 2-D Shannon, 20-Q-EL&RR, extended production to the northwest with a 2,019-bbl. daily potential. Gage was through ¾-in. choke, from pay at 8,118-55 ft. Gravity was 50°, gas-oil ratio was 1,690:1.

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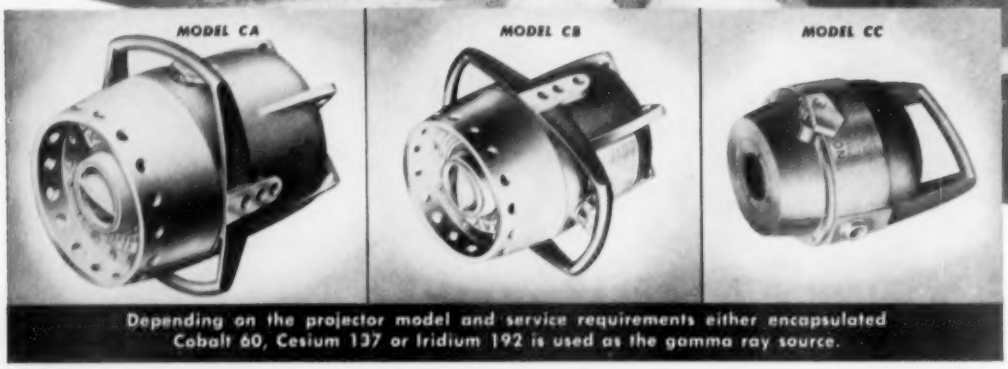
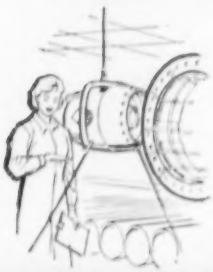


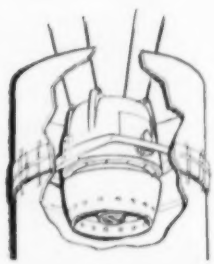
Depending on the projector model and service requirements either encapsulated Cobalt 60, Cesium 137 or Iridium 192 is used as the gamma ray source.

NON-DESTRUCTIVE INSPECTION and TESTING



SAFE

KEL-RAY projectors have extremely low radiation leakage. . . so low they can be shipped and stored without additional shielding. They are tamper, fire, and shock proof. Operated under prescribed procedures, leakage is below the AEC limit.

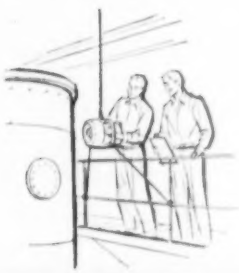


VERSATILE

A single set-up can produce either spot, doughnut, or hemisphere panoramic radiographs. Thick steel sections can be radiographed; sensitivity is so great even incandescent lamp filaments have been radiographed with a KEL-RAY projector.

CONVENIENT

Designed for field or shop use, the smallest model can be carried by hand—largest is transported and positioned speedily with standard equipment for materials handling and rigging.



ECONOMICAL

Initial and operating costs are low. No delicate parts to pamper or adjust . . . no expensive electrical power source required. Minimized overall set up and exposure time provide further savings.

Each of the three KEL-RAY Projector models is a portable, powerful, shielded, self-contained source of penetrating radiation for non-destructive inspection in maintenance, construction or quality control. There is a KEL-RAY Gamma Ray Projector that can improve your operations —save you time and money! Write for detailed literature.

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GULF COAST

TEXAS GULF COAST

Oil Production Opened in New Hynes Bay Discovery

Arkansas Fuel Oil Corp. has a new oil-discovery well in Hynes Bay, 2 miles southwest of Seadrift, Calhoun County. It is 3,300 ft. southeast of a gas-condensate discovery well completed last August by C. G. Glasscock, with Arkansas Fuel Oil Corp. and Tidelands Oil Co. as joint operators.

The oil discovery, in State Tract 102, was rated good for 156 bbl. of oil per day, flowing through ⅛-in. choke. Its flowing pressure gaged 1,250 psi. Gas-oil ratio was 1,705 cu. ft. per barrel. Gravity of the oil was 43.5°. Production is from Frio sand, perforated at 7,711-16 ft. Hole was drilled to 8,026 ft.

Pay-zone of the gas-condensate discovery well is perforated at 7,820-28 ft. Its potential flow was at the rate of 21,000 M.c.f. daily with condensate recovery of 41.4 bbl. per million cubic feet. Shut-in pressure is 2,855 psi. Total depth was 8,304 ft.

Arrow points to Arkansas Fuel Oil Corp.'s new oil-discovery well, in Hynes Bay, Calhoun County. Also indicated are the area's recently completed gas-condensate discovery-well (A), and (B) Arkansas Fuel's drilling operation, 1½ miles west.

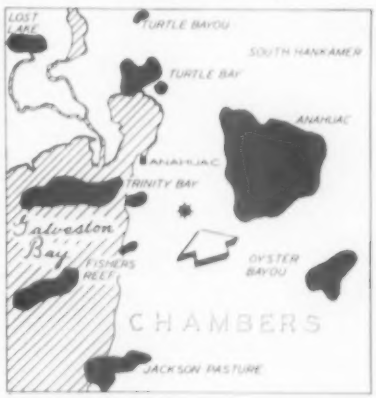
The area's third test, being drilled by Arkansas Fuel Oil Corp., is nearing the oil well's productive level. Its location, in Tract 66, is about 1½ miles west of the oil discovery.

Gas-Condensate Producer Opens New Anahuac Area

A new gas-condensate field, opened 3½ miles southeast of Anahuac, on the east side of Galveston Bay, has been opened with a discovery by Kilroy Oil Co. of Texas, Inc.

The discovery well, 1 Smith Unit, in the Anson Taylor Survey, is rated good for 16,000,000 cu. ft. of gas daily, open-flow. It has a gas-liquid ratio of 56,000 cu. ft. per barrel. Gravity of the liquid is 55.8°. Pressure of the well, shut-in, is 3,939 psi.

Location is about 3 miles southwest of Anahuac field. It is about the same distance inland from the bay.



Kilroy Oil Co.'s new gas-condensate discovery (indicated by arrow) southeast of Anahuac, in Chambers County.

Reworked Dry Hole Opens New Jackson County Field

John B. Coffee's new discovery well northwest of East Mauritz field, in eastern Jackson County, near the Wharton county line, flowed at the rate of 138 bbl. of 43°-gravity oil per day on potential gage through 7/64-in. choke. Flowing pressure was 1,100 psi., and gas-oil ratio 750 cu. ft. per barrel.

Location (indicated by arrow) of John Coffee's new oil-discovery well in eastern Jackson County.

The well, 1-F Kountz & Stewart, in the T. M. Dorsett Survey, previously (in 1948) had been abandoned as a dry hole with total depth of 7,841 ft. The present operator cleaned out to 6,767 ft., cemented casing at that depth, and perforated at 3-ft. interval at 6,725-28 ft.

Location is 9 miles southeast of Ganado.

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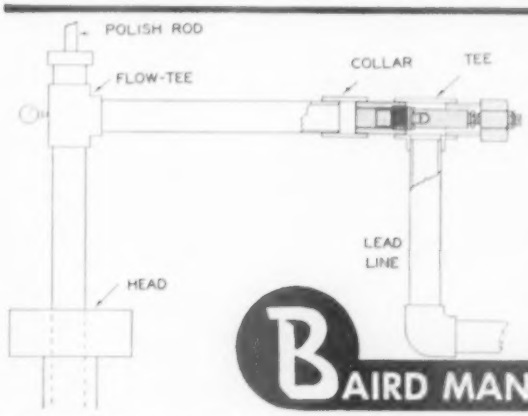


BACK-PRESSURE REGULATOR *Keeps pressure on tubing strings*

For wells that head up and flow, back pressure on the tubing tends to keep the tubing full which prevents stuffing box trouble and increases pump efficiency. By maintaining a back pressure on the tubing, this regulator keeps gas from breaking out of solution and thus helps to prevent paraffin formation.

BAIRD MANUFACTURING Co. P. O. BOX 380 TULSA, OKLAHOMA

SOUTH LOUISIANA

Vermilion Parish Gets New Oil Producing Area

A new oil-productive area has been opened in northern Vermilion Parish. Its discovery well, drilled by SoRelle & SoRelle, of Houston, is 3 miles north of Abbeville field, nearest production. Potential flow was gaged at 192 bbl. daily through ⅛-in. choke with pressure of 4,800 psi. Gas-oil ratio was 4,500 cu. ft. per barrel. Gravity of the oil is 55°.

The well, designated as 1 E. Trahan, was drilled to 14,190 ft., and has pipe cemented at 14,134 ft. Perforated producing interval is 13,936-46 ft. Tentative name of the new field is "Leroy."

During pre-potential tests, the well flowed at rates up to 368 bbl., with 1,500,000 cu. ft. of gas per day. This flow was on a 5-hour gage through 7/32-in. choke. Completion has been delayed by a fishing job occasioned by collapsed tubing.

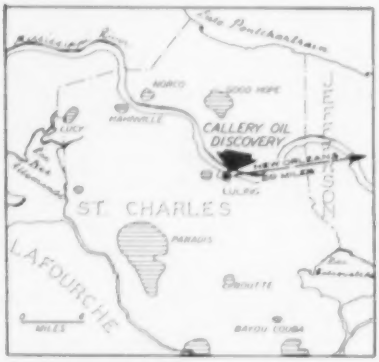
Portion of Vermilion Parish showing location, indicated by arrow, of SoRelle & SoRelle discovery well.

New Oil Field Uncovered Under Mississippi River

A new oil field with production under the bed of the Mississippi River has been opened in St. Charles Parish. Surface location is on the bank of the river, inside the levee on the north side of the Luling townsite, 20 miles up the river from New Orleans. Hole was deflected northwesterly to bottom location 50 ft. from the bank under the river.

Discovery well was drilled by F. A. Callery, Inc., on State Lease 2160. Total depth is 12,396 ft. with production from casing-perforated interval at 12,290-12,300 ft. Completion flow, through 7/64-in. choke, was at the rate of 672 bbl. of 42°-gravity oil per day with pressure of 6,800 psi. Gas-oil ratio was 440 cu. ft. per barrel.

The discovery is 1½ miles northeast of Luling field.



Location (indicated by arrow) of F. A. Callery, Inc., oil-discovery well under Mississippi River at Luling, in St. Charles Parish.

Successful Wildcats

ALBERTA

Texaco-McColl A-3-18 Hespero, LSD 3, 18-38-3w5. Basal Quartz gas well. TD 9,342 ft.

Amerada 9-10 Crown "AM," LSD 9, 10-74-1w6. Indicated granite wash oil well. TD 9,883 ft.

Fina-Cities Service 12-36 Windfall, LSD 12, 36-59-15w5. D3 gas well. TD 10,930 ft.

ARKANSAS

Columbia County: New pay discovery in Magnolia field. J. B. Downs 1 Spain, C NW SW 18-17s-19w. IPP 110 BOPD 31°, Rodessa 3,222-24 ft. TD 4,664 ft. (Oil well.)

CALIFORNIA

Kern County: Exeter Oil Co., 16-1 Exeter Willmax, SW NW 16-32s-23e. IPP 550 BOPD, 21° gravity, perfs. 4,760-4,975 ft., 36 per cent cut, TD 5,200 ft., plugged back to 5,017 ft. (Deeper pool discovery in Midway Sunset field, Kern County.)

COLORADO

Larimer County: McElroy Ranch 1 Bunker, C SE SW 29-5n-68w. IPF 126 BOPD, Lakota discovery, new field. TD 5,698 ft. Morrison.

Washington County, Wetzel Creek: Dawson & Cramer 1 Kalous, C SE NW 19-2s-56w. IPP 150 BOPD, "J" sand discovery, new field. TD 5,367 ft. "J" sand.

Weld County, Turner: Houser Drilling Co. 1 Turner, NW SW SE 1-7n-59w. IPP 5 BOPD, "D" sand discovery, new field. TD 6,584 ft. "J" sand.

KANSAS

Barton County: Leben and C.R.A. 1 Gagleman, SE SE NE 29-19s-15w. Arbuckle discovery. Opens Northeast Behrens pool.

Clark County: Steards Petroleum Co. 1 Strodtman, C SE NW 3-31s-21w. Mississippian discovery. Opens Cavalry Creek pool.

Edwards County: Skelly Oil Co. 1 Miller, NE NW NE 12-25s-16w. IP 2,860 M.c.f. of gas per day, conglomerate. TD 4,655 ft. Opens Edstaff pool.

Kingman County: Aurora Gasoline Co. 1 Hufford, NW NW NE 23-30s-7w. IP 178 BOPD, Mississippian. TD 4,725 ft. Opens Reida pool.

Kiowa County: Falcon-Seaboard and Gulf Oil Corp. 1 Herring, NW NW NE 15-28s-16w. IP 4,800 M.c.f. of gas per day. TD 4,819 ft. Opens Wellsford pool.

Reno County: Kirk Johnson 1 Beck, SW NE NW 24-23s-9w. Conglomerate discovery. TD 4,130 ft. Opens Beck pool.

Sheridan County: Barnett Oil Co. 1 Reed, NW NW SE 35-6s-27w. Temporarily abandoned after pumping 8 bbl. of oil per day from Lansing. TD 4,622 ft. Opens Chicago pool.

Trego County: Lafayette Oil Co. 1 Homburg, SE SW SW 11-13s-21w. Marmaton discovery. TD 4,151 ft. Opens Homburg pool.

SOUTH LOUISIANA

Acadia Parish: Vincent & Welch, Inc., and George McGhee 1 Hensgens, 13-8s-1w. IP 1,575 M.c.f. daily and 56.4 BCPD, 5/32-in., 48°, perforations 10,422-26 ft. TD 11,113 ft. (Extension and new pay for Grand Coulee field.)

Cameron Parish: Fifteen Oil Co. 1 Cameron Parish School Board, 16-15s-5w. IP 1,500 M.c.f. daily and 10 BCPD, ⅝-in., perforations 11,828-31 ft. TD 13,024 ft. (New field.)

St. Charles Parish: F. A. Callery, Inc., 1 State Lease 2160, 13-13s-21e. IP 672 BOPD, 7/64-in., 42°, perforations 12,290-12,300 ft. TD 12,396 ft. (New field.)

MANITOBA

California Standard 1-31 Butler, LSD 1, 31 9-29w1. Lodgepole oil well. TD 3,031 ft.

NEBRASKA

Kimball County: Maxey Drilling Co., Cabeen Exploration Co. 1 Hein, C NW NW 33-14n-55w. IPP 256 BOPD, "J" sand discovery, new field. TD 6,364 ft. Skull Creek.

Watkins Oil Co. 1 Cizek, W½ SW SW 3-16n-53w. IPP 150 BOPD, "J" sand discovery, new field. TD 5,760 ft. "J" sand.

NORTHWEST NEW MEXICO

San Juan County: C. M. Carroll 1 Ute, SW SE SE 14-31n-15w. IPP 190 BOPD, Tocito discovery, new field. TD 2,400 ft. Tocito.

OHIO

Perry County: C. M. Foraker et al 1 Edith Kelly, Sec. 9, Hopewell Twp. IP 710 M.c.f. daily, Berea 715-738 ft. TD 802 ft.

OKLAHOMA

Carter County: Frankfort Oil Co. 2 Cathey, SE SE SE 20-4s-3w. IPF 45 BOPD, Viola lime 4,160-4,230 ft., 13/64-in. choke, 34°. TD 4,325 ft. (Oil discovery.)

Cleveland County: Slick Oil Co. 1 Foster, 1½ miles west of East Stella pool in CSW NW 28-10n-1e. IPP 28 BOPD, unconformity 5,810-20 ft., 37.8°. TD 6,387 ft. (Oil discovery.)

Cleveland County: Fred Morgan 1 Shroyer, 1¼ miles northeast of West Short Junction, NW NW 13-10n-4w. IPF 200 BDPD, 11,000 M.c.f. of gas per day, Bois d'Arc 7,799-7,818 ft., 2-in. on casing, 60°. TD 8,195 ft. (Gas-distillate discovery).

Garfield County: Gibralter Oil Co. 1 Meier, 1⅛ miles northwest of Brown in NE NW NW 4-20n-4w. IPF 52 BOPD, second Wilcox sand 6,394-6,448 ft., 12/64-in. choke, 41°. TD 6,581 ft. (Oil discovery.)

Garvin County: Superior Oil Co. 1 Glover, SE NE NE 7-4n-2w. IPF 170 BOPD, 7,368-85 ft., 39.9°, 16/64-in. choke. TD 8,527 ft. (Oil discovery.)

Grant County: Calvert Drilling Co. 1 Reneau,

(Continued on page 208)

PERSONALS

Profit Split Pays

Pike Drilling president firm believer in plan

STANWOOD I. WILLIAMS is an enthusiastic believer that it pays a company to share its profits with employes. He is president of the Thomas P. Pike Drilling Co., Los Angeles, which pioneered the plan in the oil industry.

Williams says profit sharing enables Pike Drilling to develop a more unified working force. Everyone is more eager to contribute towards drilling more hole at less cost. And Williams reports the result is benefits all round—to the company, customer, and employe.

Pike Drilling since 1947 has distributed more than $400,000 in profit-sharing checks to employes at the firm's annual picnic. Only last month Williams was named general chairman of the National Conference of the Council of Profit Sharing Industries held in Pasadena.

Thomas P. Pike, former president of the aggressive drilling firm, pioneered development of profit sharing in his industry on the west coast. Other drilling firms since have adopted similar programs.

Rare species . . . Williams became president of the firm in 1953 when Pike went to Washington as assistant secretary of defense. He is a rarity—a native of California like his father, Los Angeles attorney Ernest S. Williams.

The younger Williams was graduated from Stanford University with a degree in geology in 1930. A year of postgraduate work at Massachusetts Institute of Technology rounded out his scholastic preparations for his first oil job.

Williams has centered his activities in the west. His first job was in Wyoming with Petroleum Securities Co. He spent 4 years as a roughneck on drilling rigs there and in California, filling in often as a field geologist.

In 1935, Williams went with Republic Supply Co. of California as a machinery sales engineer. Four years later he opened an office as an independent consultant, specializing in royalty evaluations. He spent the war years as assistant purchasing agent for Lockheed Aircraft Corp. and joined Pike Drilling in 1944 as a vice president. He first directed the exploration program of an affiliated company. He stepped up to executive vice president in 1948.

Looks abroad . . . Williams predicts great oil possibilities for the industry in South America. He recently returned from an extensive tour of that continent with glowing reports of the oil potential of many of its regions.

The Californian, however, does not confine his enthusiasm for the future of contract drilling just to South America. He thinks all foreign fields are potential sources of tremendous business developments. In line with that thinking he is actively seeking to expand Pike Drilling's operations with both foreign governments and U. S. producers abroad.

Pike Drilling presently has 18 strings of tools in California and 1 in Uruguay. Pike recently purchased the interests and equipment of Dunlap & Graham Drilling Co. of Long Beach to supplement the company's overseas operations.

In recent years, the Pike firm has operated in Mexico. It drilled wells for Edwin W. Pauley in northeastern Mexico and for Pemex in Lower California. The latter job required a beach landing for all drilling and camp equipment and construction of an airstrip. All supplies were delivered by air.

Williams is active in oil industry organizations. He has been chairman of the California chapter of the American Association of Oilwell Drilling Contractors and also is an active member of the American Petroleum Institute. He resides at Pasadena with his wife, the former Elizabeth Morton, and two daughters, Linda, 17, a freshman at Stanford, and Kate, 7.

Jack O. McCall, manager of Louisiana Land & Exploration Co.'s land department since 1952, has been named assistant to the president.

Charlton H. Lyons, of Lyons & Logan, Shreveport, has been elected president of the Mid-Continent Oil and Gas Association for 1956. He succeeds **Robert H. Windfohr,** Fort Worth independent. Lyons is a former president of the Independent Petroleum Association of America and earlier headed the Louisiana-Arkansas division of the Mid-Continent group. Other new officers are **Charles N. Prothro,** Wichita Falls independent, first vice president; **F. M. Robertson,** Abilene, Tex., independent, vice president for Texas; **L. Lee Welsh,** of Vicent & Welsh, Lake Charles, La., vice president for Louisiana; **E. L. Branini,** of Branini, Everett, Grantlow & Quinn, Vicksburg, vice president for Mississippi; and **David R. Stewart,** Moses & Stewart, Mattoon, Ill., vice president for Illinois. **Clarel B. Mapes,** general secretary, Tulsa, was reelected.

R. W. McOMIE

R. W. McOmie, manager of Shell Oil Co.'s new Anacortes, Wash., refinery, has been named general manager of refineries. McOmie will assume the new post January 1, with headquarters at the firm's New York offices. **R. C. Barton,** superintendent at Anacortes, will succeed McOmie as manager. McOmie joined Shell in 1927 as a chemist at the Martinez, Calif., refinery. After serving in a variety of posts at the company's West Coast refineries, he was named manager of the Wilmington, Calif., plant in 1946. When work began on the Anacortes plant, McOmie was transferred there, and took charge of development and training of operating personnel. Barton joined Shell as a chemist in 1934, and has served in many operating capacities on the West Coast. He was supervisor at Martinez before the Anacortes assignment. His post as supervisor there will be filled by **J. B. Wyman,** now assistant manager of Shell's New York manufacturing operations.

Paul D. Bowlen, president of Regent Drilling Co., Ltd., Edmonton, has bought out all assets of Regent, Northern Development Co., and affiliates of both from **Louis G. McCulloch,** former vice president. **W. R. Art Wiebe** has been named to succeed McCulloch.

F. C. Manning, Calgary business man and civic leader, has been named a director of Royalite Oil Co., Ltd.

PERSONALS

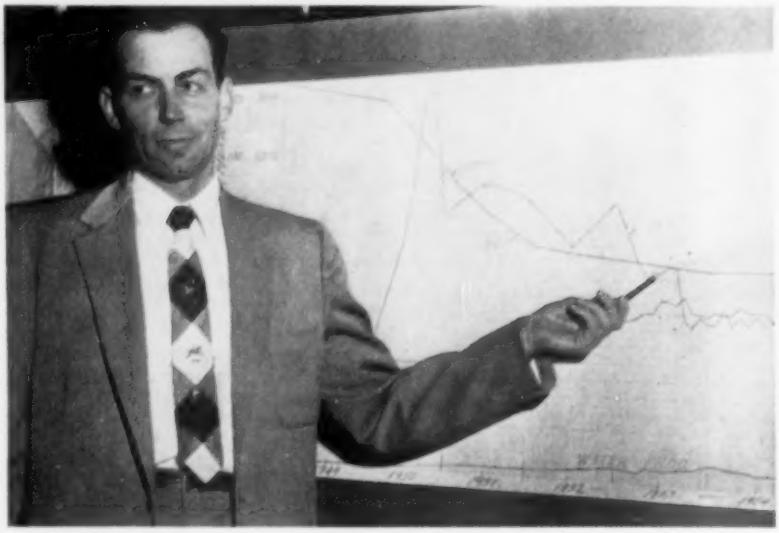
John J. Forbes, director of the Bureau of Mines, retired November 30 with a letter of "personal thanks" from President Eisenhower for his work. He had served the Government for 40 years.

C. B. Williams, West Texas division manager of The Texas Co.'s producing department, retired December 1 after 36 years' service. He has been succeeded by **L. F. Shiplet,** assistant division manager. Williams joined Texaco as an assistant engineer in Mexican operations. He later held a variety of assignments in Texas before going to Colombia in 1938 as manager of Colombian Petroleum Co., a Texaco subsidiary. He had been head of West Texas production since 1941. Shiplet joined the company in 1927 as a roustabout. He became district manager at Wink, Tex., in 1936, and later held the same posts at Midland, Tex., and Fort Worth. He was named assistant division manager in 1947. **O. F. Sebasta,** now general superintendent of drilling and production, will succeed Shiplet. **J. A. Hale,** now assistant to the manager of the South Texas division, also was named an assistant manager of the West Texas division.

L. F. Dowding, assistant director of Jefferson Chemical Co.'s Austin Laboratories in New York, has been promoted to assistant general manager of the firm's manufacturing division in Houston. Dowding joined Jefferson's engineering department in 1949 after 10 years with The Texas Co.

C. E. DAVIS

C. E. Davis, vice president of refining for Shell Oil Co., will retire January 1 after 38 years with the firm. Davis will become a consultant and will be general secretary of the Fifth World Petroleum Congress, which convenes in the United States in 1959. During World War II, he served in the Petroleum Administration for War, and from 1951 to 1953 was with the Petroleum Administration for Defense. He now is chairman of the Military Petroleum Advisory Board's refining panel. Davis became general manager of manufacturing in 1943. He was named vice president for manufacturing east of the Rockies in 1954, and assumed his present post in 1949.



SACROC Flood Working Fine, A.I.M.E. Told

Reservoir-pressure decline has been halted in the SACROC unit of the Canyon Reef reservoir in Scurry County, Texas, Dr. C. W. Ziemer, of Sunray Mid-Continent Oil Co., told a Mid-Continent section meeting of the A.I.M.E. in Tulsa. Since November 1954, 47,000,000 bbl. of water under a pressure of 2,200 psi. has been injected in the unit area. Ziemer said produced gas-oil ratios have declined to nearly the original solution ratio value. While primary gas-expansion method is expected to yield 686,000,000 bbl. over 22 additional years, water injection is expected to add 816,000,000 bbl. and extend the field's producing life another 42 years.

H. S. M. Burns, president of Shell Oil Co., has been named head of the National Petroleum Council's new committee on underground storage. The committee was set up to study the storage picture and report its findings to NPC. Members are **Hines H. Baker,** president, Humble Oil & Refining Co.; **Paul Endacott,** president, Phillips Petroleum Co.; **R. G. Follis,** board chairman of Standard Oil Co. of California; **Jake L. Hamon,** Dallas independent,; **W. Alton Jones,** board chairman, Cities Service Co.; **J. Sayles Leach,** board chairman of The Texas Co.; **R. L. Milligan,** president, Pure Oil Co.; **Sid W. Richardson,** head of Sid W. Richardson, Inc.; **Sidney A. Swensrud,** board chairman, Gulf Oil Corp.; **Reese H. Taylor,** president of Union Oil Co. of California; and **W. K. Warren,** board chairman, Warren Petroleum Corp.

C. Otis Danielson, recent manager of Mid-Continent drilling for Kerr-McGee Oil Industries, Inc., has been named to head Kermac's Gulf Coast drilling operations. Danielson joined the firm in 1940 as a roughneck. He was promoted to chief drilling engineer in 1951, and had held his recent post since November 1954. Danielson's former duties will be split among **George B. Parks, Norman Baxendale,** and **J. W. Bawcom.**

Henry Tuttle, president of Michigan Consolidated Gas Co., Detroit; **J. McWilliams Stone,** president, DuKane Corp., St. Charles, Ill.; **E. H. Tolleson,** head of Hope Natural Gas Co., Clarksburg, W. Va., and **Sheldon Coleman,** who heads Coleman Co., Wichita, have been named new trustees of the Institute of Gas Technology of the Illinois Institute of Technology, Chicago. Four other trustees were reelected to 3-year terms. They are **John Heyke, Jr.,** head of Brooklyn Union Gas Co., Brooklyn; **D. A. Huley,** president of Lone Star Gas Co., Dallas; **Louis Rutherberg,** board chairman of Servel, Inc., Evansville, Ind., and **Carl J. Sharp,** chairman, Acme Steel Co., Chicago.

Thomas M. Dailey, Jr., has resigned as petroleum economist for Humble Oil & Refining Co., Houston, to join Tide Water Associated Oil Co. as economics department manager. Dailey had been with Humble for 9 years. During World War II, he served with the Petroleum Administration for War and later with the Army-Navy Petroleum Board's planning division.

PERSONALS

W. G. WHITMAN

Walter Gordon Whitman, secretary-general of the United Nations International Conference on Peaceful Uses of Atomic Energy, has been elected president of the American Institute of Chemical Engineers for 1956. Whitman heads the chemical engineering department at Massachusetts Institute of Technology. He has been chairman of the Defense Department's research and development board since 1951 and from 1925-1934 was associate director of research for Standard Oil Co. (Ind.). Elected vice president of A.I.Ch.E. for the coming year was **J. Henry Rushton,** professor of chemical engineering at Purdue University. **F. J. Van Antwerpen,** executive secretary of the institute, and **George Granger Brown,** treasurer, were reelected.

H. A. Halsey, senior zone supervisor at Humble Oil & Refining Co.'s Baytown refinery, has retired after more than 47 years' service. Halsey was senior employe at Baytown in point of service.

M. V. Cousins and **C. C. Barnett** have been named vice presidents of United Gas Pipe Line Co., subsidiary of United Gas Corp., Shreveport. Barnett also was elected a director. Cousins has been a director since last March.

Dr. George E. Hulse has joined Spencer Chemical Co.'s research and development division as coordinator of pipeline research, a newly created position. Hulse is a former research specialist with Hercules Powder Co. **Byron M. Kern,** former chief engineer for Spencer, has been made general manager of engineering and construction. **Robert A. Byorum,** former assistant chief engineer, succeeds Kern.

Dr. A. D. Suttle has been promoted to senior research chemist in Humble Oil & Refining Co.'s research and development division at the firm's Baytown, Tex., refinery. Suttle will specialize in studies of radiation chemistry.

Richard F. Cox, former chief engineer for Southwest Gas Producing Co., Monroe, La., has been named general production superintendent. Cox will coordinate production and drilling operations.

W. S. Fitzpatrick, of Fitzpatrick Drilling Co., Corpus Christi, has been named to head the national safety committee of American Association of Oil Well Drilling Contractors.

Asa V. Call, Los Angeles life insurance executive and civic leader, has been elected a director of Standard Oil Co. of California.

Paul C. Berner has been promoted to district geologist in Lion Oil Co.'s Wichita production and exploration office. Berner replaces **C. Elton Gore,** who recently was moved up to regional geologist in the Central region. Berner joined Lion in 1953.

W. F. Rogers has resigned as president of Rogers Oil Co., Denver, to become an independent in Scottsbluff, Neb.

Glenn W. Sandberg has resigned as district geologist with Sunray Mid-Continent Oil Co. in Denver to become a consultant there.

Alan M. Bieber, Richard H. Fulton, and **Alexander S. Wyner** have joined the staff of Bell Associates, Washington oil and gas consultants. Bieber is a former independent geologist; Fulton was with Midstates Oil Corp.; and Wyner is a former mining engineer and geologist.

L. R. Goldsmith, manufacturing manager of Shell Oil Co., has been named general manager of technical departments effective January 1. He will remain in Shell's New York office.

Albert Gregerson, veteran Gulf Oil Corp. geologist, has been named Pittsburgh representative for the firm's Eastern Hemisphere production department, located in London. Gregerson will advise Gulf's production department on Eastern Hemisphere production matters and serve as liaison between Pittsburgh headquarters and the London office.

Eugene Barr, senior geologist in Sunray Mid-Continent Oil Co.'s Wichita district, has been transferred to Denver as district geologist. Barr has been at Wichita for 8 years. When promoted, he was a candidate for president of the Kansas Geological Society. **Don Rector,** geologist in Sunray's Tulsa office, has been moved to the Wichita district office.

Harold Hansen, former field engineer for British-American Oil Producing Co. at Sterling, Colo., has been promoted to district engineer at Midland, Tex. **John Freeman,** staff engineer, has been transferred from Midland to Sterling.

E. E. Fickinger, geophysical supervisor for Continental Oil Co. at Midland, Tex., has been made division geophysicist there. He replaces **J. E. Finley,** recently promoted by Conoco to the newly created post of Midland district exploration manager. Fickinger joined the company in 1947 and became geophysical supervisor last year.

DEATHS

Charles L. Bernard, 67, retired Oklahoma division manager of the Pure Transportation Co., died November 27 in Independence, Mo. Bernard, who lived in Tulsa, became ill while en route to Independence for Thanksgiving holidays. He had retired last January 1 after 38 years with Pure Oil Co. and affiliates. He was named to the Oklahoma post in 1937, and from 1941 to 1952 was superintendent of Pure's Michigan division.

James Parker, 65, area drilling representative for Arrow Drilling Co. at Midland,Tex., died there November 25. Parker had been with Arrow at Midland for 16 years and before that had worked for the firm at Lufkin and Abilene, Tex.

A. B. Johnson, retired chief engineer of Ohio Oil Co., pipeline department, died November 26 at Fort Lauderdale, Fla. He had been an Ohio Oil employe 36 years.

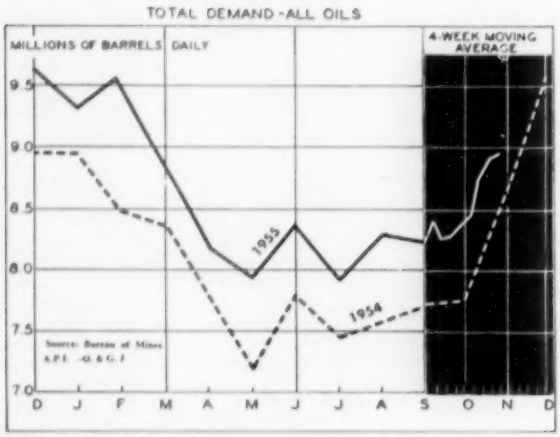
Frank E. Rehm, retired vice president of Shell Oil Co., died November 27 at his home in San Francisco. Rehm joined Shell in 1916 after graduation from Stanford University.

Francis Gene Hawk, 34, independent oil operator of Midland, Tex., died there November 23.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,861,225	UP	6,800	UP	504,830
Crude stocks	255,539,000	DOWN	2,300,000	DOWN	14,140,000
Completions	1,106	DOWN	126	UP	84
Refinery runs	7,741,000	UP	84,000	UP	767,000
Gasoline stocks	155,866,000	UP	2,286,000	UP	6,675,000
Distillate stocks	145,374,000	DOWN	3,287,000	UP	10,458,000
Residual stocks	45,045,000	DOWN	248,000	DOWN	10,468,000
Four-product stocks	380,600,000	DOWN	2,078,000	UP	4,736,000
Total imports	1,367,300	UP	64,300	UP	316,900



Higher Tanker Rates Have Absorbed Distillate Price Gain on East Coast

RECENT continuation of spot-tanker-rate increases has put more pressure on Gulf Coast spot sales. The rate for Gulf-East Coast movement of No. 2 fuel is about 75 per cent above the Maritime Commission base compared with 15 per cent below the base rate during the early part of October. Translated into increased cost per barrel, this rise adds about 0.8 cent per gallon to the delivered cost of No. 2 fuel on the East Coast.

Since the net increase due to the withdrawal of the voluntary summer allowance amounted to only 0.5 cent, the higher East Coast price failed to take the pressure off the Gulf Coast market. For a spot buyer on the Gulf Coast, the increase in tanker rates has made it impossible for him to ship and sell on the East Coast. If he buys No. 2 fuel on the Gulf Coast spot market, his cost of delivering the cargo to New York Harbor would be more than the barge price in the harbor.

The current low quotation on the Gulf Coast for No. 2 fuel is only 0.5 cent a gallon more than in late 1951. Since that date, the average crude price has moved up about 0.6 cent a gallon. The comparison shows why some Gulf Coast refiners say that they will have to cut runs rather than distillate prices.

Increases in river-barge rates this fall have tended to disrupt the barge movement up the Mississippi River, particularly into the Chicago area. Current wholesale quotations for No. 2 in Chicago are below replacement costs, for material shipped out of Helena, Ark., by barge.

Some Mid-Continent suppliers are predicting an increase in the Group 3 price for No. 2 fuel. Last year, the Group 3 low for No. 2 moved up from 8.25 to 8.375 cents in the first week of November. Another small increase in the second week of December put the price at 8.5 cents. This was followed by a gain of 0.25 cent during the last week of the year.

Normal winter weather in the North Central states should boost present quotations by 0.5 cent by the end of the year. Most of the cool weather for the northern states so far this season has been in the last half of November. Movement out of pipeline terminals has reflected increased demand in line with these lower temperatures.

Group 3 prices for natural gasoline have shown a spread of 0.25 cent a gallon for the past week. Marketers report the normal Group 3 market for Grade 26-70 at 6.0 cents a gallon, but some sales are reported at both 5.875 cents and 6.125 cents.

The lower price of 5.875 cents is related to certain gas contracts which call for higher gas prices when the 26-70 natural-gasoline price goes to 6.0 cents. Under these contracts it takes a price of 6.25 cents for natural to balance the increase in gas costs. Gasoline marketers are predicting that the price either will drop back to 5.875 cents or move up to 6.25.

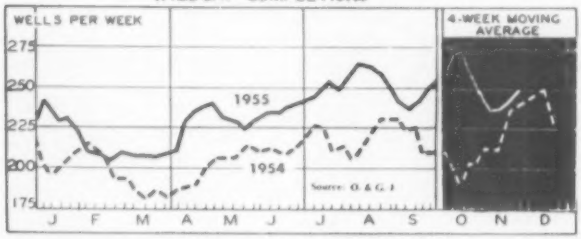
The following table shows the spread between the low of quotations for regular gasoline on the Group 3 market and the price paid for 26-70 natural in past years.

GROUP 3 SPREAD BETWEEN REGULAR AND NATURAL GASOLINE LOW OF REGULAR VS. GRADE 26-70

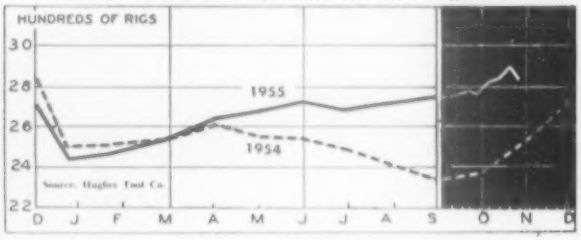
(Cents per gallon)

	Spread on Jan. 1	March 31	June 30	Nov. 30
1948	1.750	2.000	2.000	1.750
1949	1.750	3.875	4.125	3.625
1950	3.625	5.375	4.750	4.000
1951	3.250	3.750	4.750	3.375
1952	3.250	3.625	4.875	3.500
1953	3.500	4.625	5.875	5.500
1954	5.375	6.250	6.125	4.750
1955	4.875	5.750	5.750	5.125

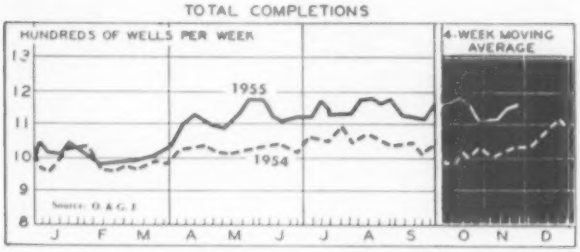
WILDCAT COMPLETIONS



ROTARY RIGS OPERATING IN THE UNITED STATES



TOTAL COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	11-28-55	Change from 11-21-55	Change from 11-29-54
Gulf Coast	598	—15	54
N. and W. Texas-New Mexico	953	—40	138
Arkansas-N. Louisiana-E. Texas	173	1	—14
Oklahoma	345	—16	16
Kansas-S. Nebraska	198	4	14
Illinois-Eastern	136	—13	—14
Rocky Mountain	279	8	16
Pacific Coast	147	2	7
Total United States	2,829	—69	217
Western Canada	217	1	25

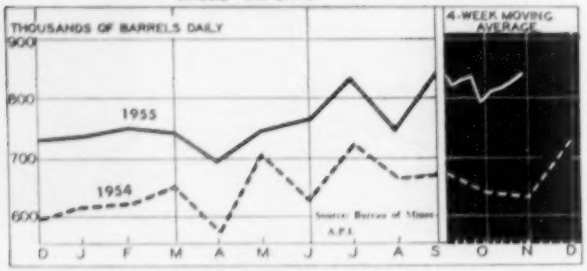
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 26, 1955

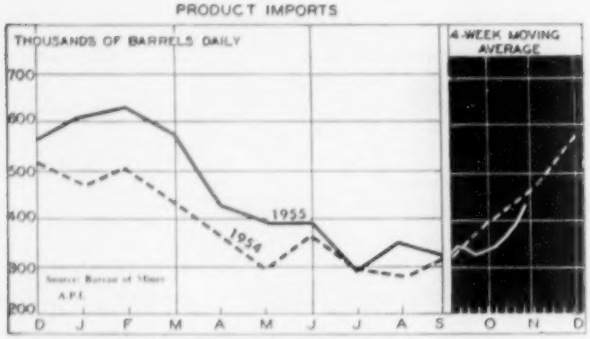
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	1	0	0	1	12,630	68	94	0	0	0	1	1	1	0	0	65	66
Arkansas	15	7	0	8	44,890	739	546	1	0	0	4	5	33	1	4	153	191
California	53	38	2	13	225,969	2,204	2,133	1	0	0	8	9	40	0	11	404	455
Colorado	18	5	2	11	100,889	1,342	1,198	3	0	0	8	11	47	0	22	652	721
Illinois	84	45	1	38	198,633	3,528	2,658	3	0	0	14	17	64	0	5	500	569
Indiana	12	6	0	6	17,519	655	788	0	0	0	2	2	11	0	0	240	251
Kansas	92	40	9	*43	334,946	4,534	4,108	3	0	1	21	25	128	1	33	767	929
Kentucky	34	13	3	18	44,895	1,455	1,049	0	0	0	7	7	52	0	9	307	368
Louisiana	83	52	8	23	543,536	3,664	3,126	1	1	0	10	12	104	74	28	426	632
North	47	28	7	12	191,069	1,901	1,708	0	0	0	6	6	23	11	4	178	216
South	36	24	1	11	352,467	1,763	1,418	1	1	0	4	6	81	63	24	248	416
Michigan	9	5	0	4	21,316	478	513	0	0	0	3	3	12	0	1	181	194
Mississippi	10	3	0	7	71,883	413	377	0	0	0	6	6	14	0	0	154	168
Montana	3	2	1	0	9,690	364	303	0	0	0	0	0	13	0	1	138	152
Nebraska	12	5	0	7	60,537	796	389	2	0	0	5	7	41	0	1	329	371
New Mexico	28	14	10	4	129,467	1,537	995	1	0	0	2	3	39	2	10	102	153
Northwest	11	1	9	1	33,885	530	357	1	0	0	1	2	8	1	10	30	49
Southeast	17	13	1	3	95,582	1,007	638	0	0	0	1	1	31	1	0	72	104
North Dakota	4	4	0	0	23,119	236	275	0	0	0	0	0	6	0	0	59	65
Ohio	22	10	5	7	46,140	1,107	1,044	0	0	1	0	1	3	0	8	16	27
Oklahoma	155	86	6	163	535,403	7,723	7,962	4	0	0	11	15	128	18	26	595	767
Pennsylvania-New York	31	8	14	19	59,892	1,364	2,020	0	0	0	0	0	0	0	7	10	17
Texas	414	263	13	138	1,797,814	18,280	16,676	22	2	3	82	109	712	99	119	3,755	4,685
Southwest (1 & 4)	56	33	3	20	218,209	2,811	2,316	3	2	0	9	14	108	32	36	714	890
Gulf Coast (2 & 3)	54	18	6	30	365,549	2,301	2,352	2	0	1	18	23	86	54	39	615	794
East (5 & 6)	31	15	3	13	165,164	899	907	0	0	0	8	8	22	5	9	298	334
North Central (7-B & 9)	149	88	0	61	472,243	6,801	6,371	12	0	0	37	49	339	0	16	1,482	1,837
West (7-C & 8)	104	90	1	13	504,739	4,505	3,863	4	0	0	9	13	151	1	10	613	775
Panhandle (10)	20	19	0	1	71,910	963	867	1	0	0	1	2	6	7	9	33	55
Utah	0	0	0	0	0	80	77	0	0	0	0	0	6	0	6	50	62
West Virginia	12	0	7	5	25,432	592	554	0	0	1	0	1	0	0	11	19	30
Wyoming	14	4	0	10	83,827	882	1,117	0	0	0	7	7	25	0	8	195	228
Miscellaneous	0	0	0	0	0	58	114	0	0	0	0	0	4	0	3	46	53
Total United States	**1,106**	610	81	415	4,388,427	52,039	48,116	41	3	6	191	**241**	1,483	195	313	9,163	11,154
Total previous week	1,232	697	75	460	4,762,622			26	4	6	214	250	1,442	192	307	8,972	10,913
Total November 27, 1954	1,022	540	69	413	4,115,211			20	3	8	196	227	1,317	128	367	8,240	10,052
Western Canada	55	38	1	16	254,767												

Service wells included *1, †12, ‡5.

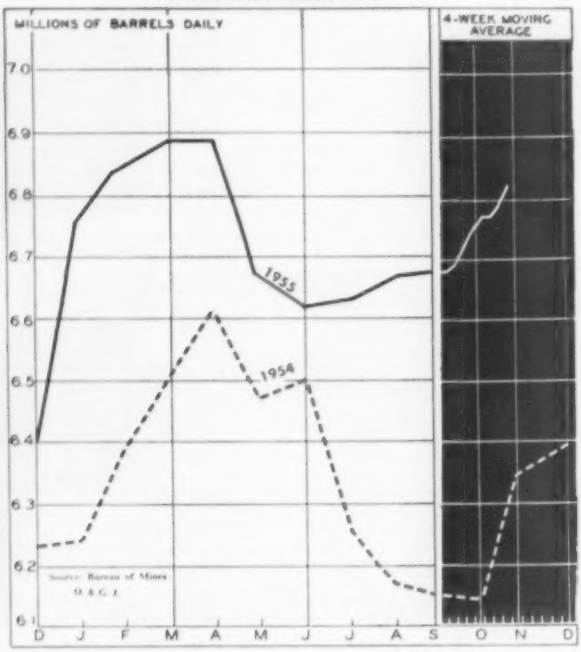
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

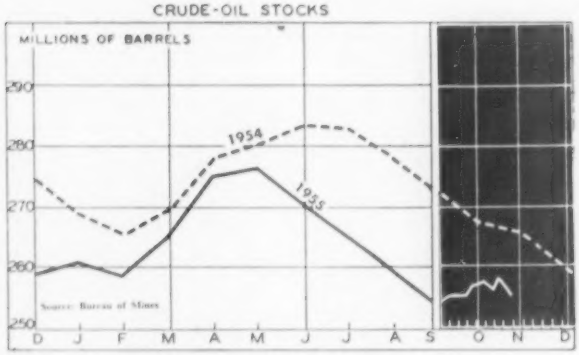


DAILY AVERAGE PRODUCTION FOR WEEK

	November 26			Nov. 19
	Crude oil	Lease condensate	Total	total
Alabama	4,200		4,200	4,100
Arkansas	73,900	400	74,300	73,950
California	973,100		973,100	974,400
Colorado	149,100		149,100	148,500
Eastern	52,100		52,100	52,100
Florida	1,350		1,350	1,350
Illinois	227,600		227,600	228,400
Indiana	29,600		29,600	29,700
Kansas	329,300		329,300	333,900
Kentucky	42,800		42,800	43,800
Louisiana	703,500	57,600	761,100	762,400
North	113,500	2,600	116,100	117,400
South	590,000	55,000	645,000	645,000
Michigan	32,500		32,500	32,200
Mississippi	105,600	4,700	110,300	110,300
Montana	39,800		39,800	40,400
Nebraska	28,600		28,600	28,100
New Mexico	228,800	3,550	232,350	232,350
North Dakota	33,700		33,700	28,300
Oklahoma	576,100		576,100	566,200
Texas	2,834,200	50,925	2,885,125	2,885,125
Dist. 1	54,000	525	54,525	54,525
Dist. 2	151,400	7,975	159,375	159,375
Dist. 3	408,000	24,500	432,500	432,500
Dist. 4	239,000	5,150	244,150	244,150
Dist. 5	48,500	425	48,925	48,925
Dist. 6	125,000	5,300	130,300	130,300
East Texas field	219,500		219,500	219,500
Dist. 7-B	149,000	50	149,050	149,050
Dist. 7-C	170,000	4,300	174,300	174,300
Dist. 8	965,000	2,000	967,000	967,000
Dist. 9	214,800	500	215,300	215,300
Dist. 10	90,000	200	90,200	90,200
Utah	5,000		5,000	4,800
Wyoming	272,900		272,900	273,800
Others	‡300		‡300	250
Total U. S.	6,744,050	117,175	**6,861,225**	6,854,425
Change from previous week, up			**6,800**	
Canada	†404,700		†404,700	†425,600
Total U. S. production January 1-November 26			2,225,614,475 bbl.	
Same period last year (crude plus cond.)			*2,092,701,195 bbl.	

*Includes 32,174,025 bbl. condensate. †Week ended previous Monday. ‡S. D. 100, Nev. 200.

CRUDE-OIL STOCKS



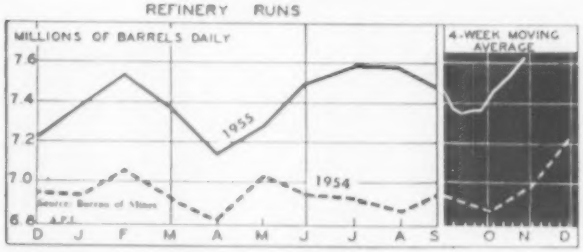
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

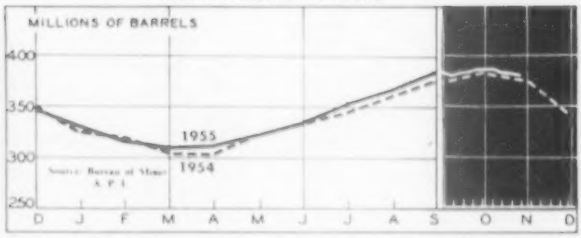
	11-19-55	11-12-55	11-20-54
Pennsylvania Grade	3,096	3,058	3,166
Other Appalachian	1,941	1,863	1,930
Illinois, Indiana, Michigan	9,277	9,538	12,411
Nebraska, North Dakota	2,313	2,380	2,073
Kansas	7,855	8,032	8,561
Oklahoma	21,617	21,402	26,608
Arkansas	2,200	2,424	3,031
Louisiana	15,981	15,947	15,646
North	2,527	2,524	2,416
South	13,454	13,423	13,230
Mississippi	2,951	3,099	3,195
New Mexico	7,328	7,179	8,038
Texas	122,689	123,035	122,582
East Texas proper	9,175	8,997	10,387
West Texas	57,541	57,721	55,929
Texas Gulf	24,680	25,464	23,431
Other Texas	31,293	30,853	32,835
Wyoming	14,908	14,619	13,321
Other Rocky Mountain	5,926	5,733	6,135
California	26,274	26,981	31,317
Foreign	†11,183	12,549	11,665
Total	255,539	257,839	269,679

*Bureau of Mines. †Includes 2,294,000 bbl. in California.

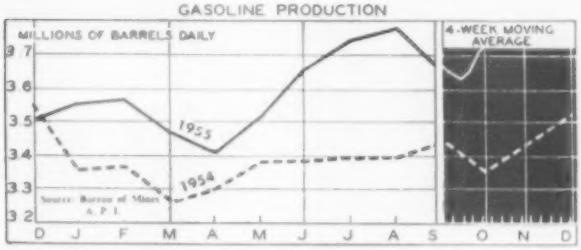
REFINERY RUNS



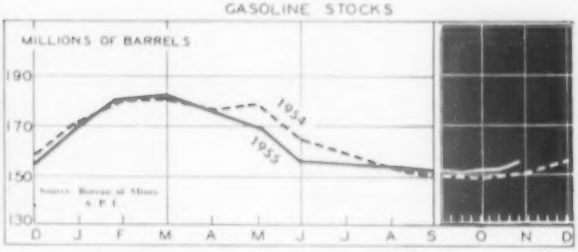
FOUR-PRODUCT STOCKS



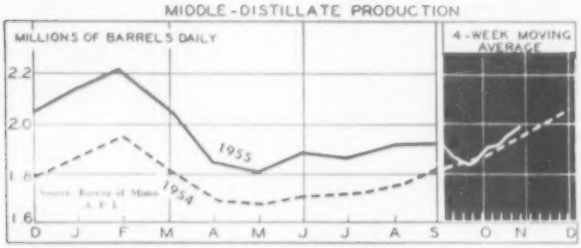
GASOLINE PRODUCTION



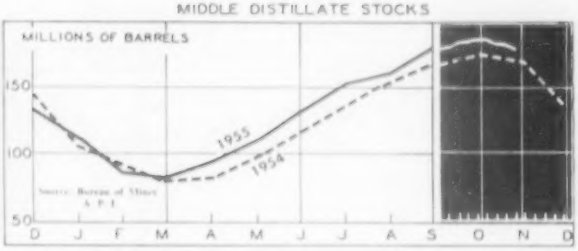
GASOLINE STOCKS



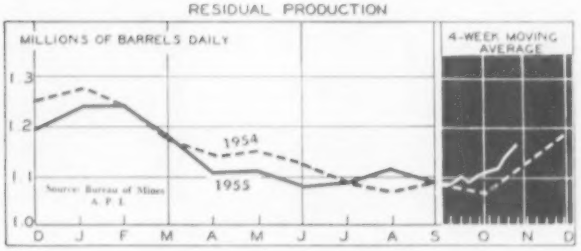
MIDDLE-DISTILLATE PRODUCTION



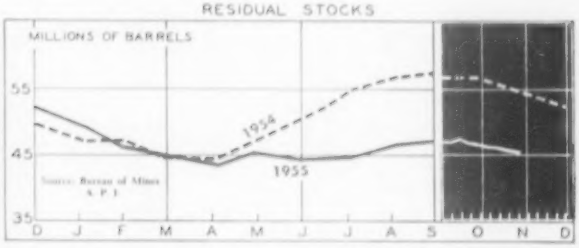
MIDDLE DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, NOVEMBER 25

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1954: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,114	406.0	23.1	257.4	234.3	36,784	14,706	55,083	12,748	989	417.6	28.7	267.6	194.4
Appalachian:														
District 1	114	46.7	4.6	21.3	7.9	4,474	660	3,026	610	93	44.0	5.3	19.9	6.5
District 2	100	54.4	5.9	15.7	13.9	2,388	544	1,183	455	74	33.4	5.9	12.4	8.4
Ind., Ill., Ky.	1,417	784.4	74.3	285.7	184.8	31,632	8,438	28,011	4,725	1,267	670.6	77.6	264.8	168.5
Okla., Kans., Mo.	719	405.3	14.6	169.7	41.3	15,180	2,060	14,945	1,580	623	352.6	17.4	160.7	38.0
Inland Texas	246	182.6	7.1	44.6	20.1	5,804	470	2,815	1,297	224	176.9	9.2	40.9	22.6
Texas Gulf Coast	1,902	884.0	139.6	473.3	263.4	19,693	3,161	16,650	7,385	1,754	824.0	128.7	443.9	233.5
La. Gulf Coast	676	335.4	65.3	158.7	43.1	9,321	2,429	6,414	1,389	603	311.7	64.8	164.5	39.7
N. La. and Ark.	95	38.3	4.7	28.3	6.6	4,074	1,095	2,270	74	88	38.0	7.4	22.5	6.6
Rocky Mountain:														
New Mexico	20	10.6		3.7	2.7	251	7	52	30	20	11.2	0.7	3.1	3.1
Other Rocky Mtn.	263	124.4	3.1	63.3	40.9	5,192	316	2,764	854	227	108.5	3.9	53.7	33.6
California	1,075	470.9		170.3	369.6	21,073	429	12,161	13,898	1,013	439.9	4.4	168.2	364.9
Nov. 25, 1955	7,741	3,743.0	342.3	1,692.0	1,228.6	155,866	34,315	145,374	45,045	6,975	3,428.4	354.0	1,622.2	1,119.8
Nov. 18, 1955	7,657	3,758.6	335.9	1,706.9	1,177.4	153,580	35,144	148,661	45,293					
Nov. 26, 1954	6,974	3,447.1	359.0	1,555.4	1,094.4	149,191	36,244	134,916	55,513					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 11-25-55	3,741	3,696
August 1955	3,858	4,033
October 1954	3,362	3,515
November 1954	3,428	3,505
Middle distillate:		
Four weeks ended 11-25-55	1,997	2,310
August 1955	1,910	1,377
October 1954	1,854	1,509
November 1954	1,976	2,247
Residual fuel:		
Four weeks ended 11-25-55	1,169	1,624
August 1955	1,090	1,439
October 1954	1,066	1,429
November 1954	1,120	1,560

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.97			
15-15.9	2.03			
16-16.9	2.09			
17-17.9	2.15			
18-18.9	2.21			
19-19.9	2.27			
20-20.9	2.33	$2.50		$2.37
21-21.9	2.39	2.52		2.39
22-22.9	2.45	2.54		2.41
23-23.9	2.51	2.56		2.43
24-24.9	2.57	2.58	$2.91	2.45
25-25.9	2.63	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Sour. Includes New Mexico Permian.

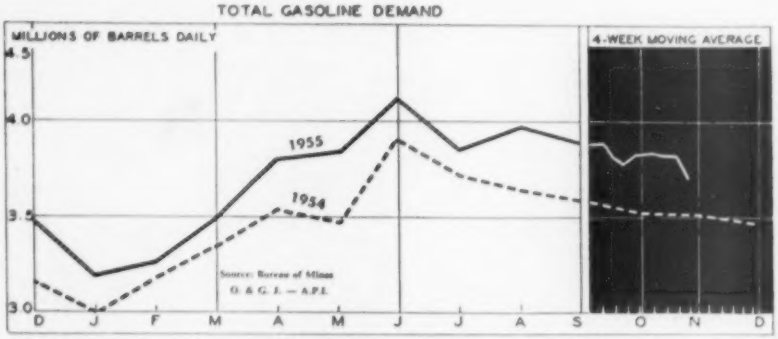
Effective dates. California, October 17, 1955; east of California, June 15, 1953; Pennsylvania Grade, December 1, 1955.

FLAT CRUDE PRICES

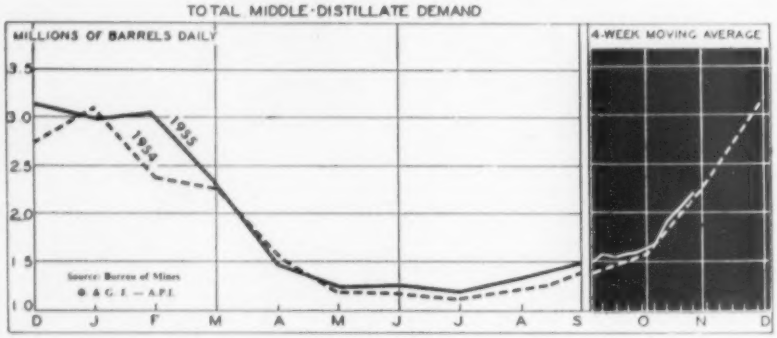
Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.85
Middle District	3.72
Southwest Pennsylvania	3.43
West Virginia	3.31
Buckeye Grade	3.25
Zanesville Grade	2.87
Illinois Basin	3.00

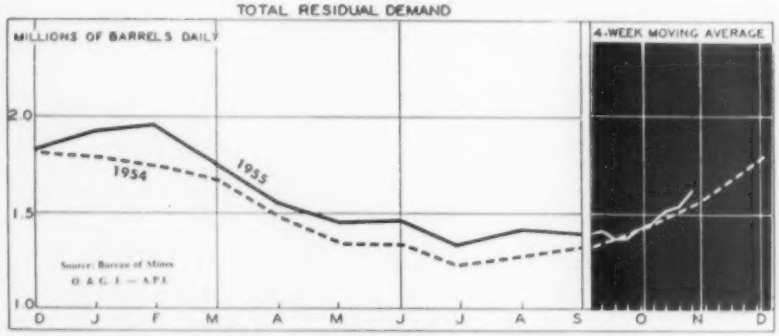
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of November 30, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	11-11.25	11.5-12	10.5-10.75
Premium gasoline	12.5-12.75	13-13.75	12-12.25
42-44 w.w. kerosine	9.25-9.50	10.55	8.75-9.00
No. 2 straw fuel oil	8.25-8.50	10.05	8.5-8.75
No. 6 residual	$1.75-1.85	$2.65-2.75	$2.10-2.20

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.875-6.125	5.5	5.75
Grade 18-55	7.05-7.35	6.7	6.95

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	19
200 vis., No. 3 neutral, 0-10 pp.	14.25

WAX

Mid-Continent

132-134 A.M.P.	0.6

• All suppliers in the northern part of the East Coast have discontinued the 0.5-cent voluntary allowance on kerosine and distillate fuels, but the gain has gone into increased tanker rates. Group 3 quotations for Grade 26-70 natural gasoline are spread from 5.875 cents per gallon to 6.125 cents. Some suppliers are predicting higher No. 2 prices on the Group 3 market.

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

CLASSIFIED ADVERTISING

FOR SALE EQUIPMENT

GARDNER-DENVER two-stage gas compressor unitized unit powered by 250 H.P. Buda motor and all equipment, gauges and coolers necessary to operate. All in first-class condition. Gulf Southwest Service Co., P. O. Box 1328, Shreveport, La. Telephone 2-8436.

FOR SALE: Used R. L. Cardwell Drilling-in Unit. Splendid condition with all accessories and large Doghouse. Located near Wichita. Phone or write John Richard, McClelland Hotel, Wichita, Kansas; or write Box 361, Topeka, Kansas.

FOR SALE: National T-12 rig on 32' Tandem Trailer, 145 HP Motor, complete except drill pipe. First class condition, approx. 8 months old. Box J-233, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE substantially below mill price 50,000 lbs. new Tubes, 70% Copper, 30% Nickel, 5/8" O.D. x .049" Wall. Lengths: 9', 9'2", 12'6", 12'8". Hugo Neu Corporation, 31 Nassau St., New York 5, N. Y.

GASOLINE PLANT EQUIPMENT FOR SALE

3—800# MMCF Absorbers with Scrubbers, etc.

1—30" x 62' Depropanizer with Accumulator, Reboiler and Condenser.

1—Fluor "Counterflo" Induced Draft Cooling Tower Complete.

Other equipment, Instruments, Pumps, Pipe, Valves and Fittings necessary in Gasoline Plant Construction. Detailed Inventory Available upon request.

SOUTHERN PRODUCTION COMPANY, INC.

P. O. Box 670, Phone FAnnin 8103, Fort Worth, Texas

NEW TRAILERS

DROP—BED "TYPE" $2,731.48
FLAT—BED "TYPE" 2,638.89

Plus 8% Tax

Built To Order

PASKO MACHINERY & STEEL
1721 CHICAGO DRIVE S. W.
GRAND RAPIDS, MICHIGAN

FOR SALE EQUIPMENT

FOR SALE—5000' Drilling Rig—Complete for South Texas Drilling—Completely Overhauled—For Price and Complete Inventory write—McKENZIE DRILLING COMPANY, 717 WILSON BUILDING, CORPUS CHRISTI, TEXAS.

FOR SALE—At our Wichita gasolene plant, 901 West McArthur Road, 1—6'x8' Vertical Flint Steel Corp. Gas Scrubber with 3 Trays Mist Extractor, Shell 1⅝", Heads 1⅛" Code Welded, stress relieved, design max. WP 400# PSI. Max temperature 100 F. New 1948, $2500.00. Cities Service Oil Patridge, Bartlesville, Oklahoma.

FAILING 1500 heavy duty drill with 4½ x 5 pump, automatic pulldown, and mounted on Ford truck. Write P. O. Box 819, Longmont, Colo. Phone 1333.

SAVE MONEY

on

8" LINE PIPE

LAPWELD 8⅝" O.D. 28.55

Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.

Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi. Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ½ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

Brokers and agents protected.

REDNEB PIPE CO.
P. O. Box 1798 Shreveport, La.
Phone 4-7767—68

FOR SALE EQUIPMENT

ELI DRILL M6D-164-D on 1948 Ford. New Motor, good rubber. 22' Mast, 13" Kelley, 4½ x 5 G-D Pump, 150' Rod, slush pit and bit subs. SeisDrill, Inc., 515 Thompson Bldg., Tulsa, Oklahoma.

FOR SALE: Autocar Diesel C-100, 1949 model. Dual tandem with Braden C-90 winch, in excellent condition, worth the price. Contact Phone #740, or write P. O. Box #346, Sullivan, Indiana.

PORTABLE IRRIGATION UNIT—Mounted on a 6-wheel drive GMC truck. Purchased new in 1951 at a cost of over $22,500. Le Roi engine (Model H-540). Gould pumps. 2500 feet of 8" aluminum pipe. 1500 feet of 6" aluminum pipe. 200 couplers and fittings. All other equipment necessary plus many extras. First-class condition in every respect, used very little. Write Post Office Box 752, Kerrville, Texas.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

LINE PIPE

7000' of 8⅝" OD, 22.36#, PE, Bev., DRL, LW, straight No. 1 used.
4000' of 10¾" OD, 34.24#, PE, Bev., DRL, LW, straight No. 1 used.
2600' of 12¾" OD, 39.89#, PE, Bev., DRL, LW, straight No. 1 used.
2000' of 12¾" OD, 39.89#, PE, Bev., SRL, LW, straight No. 1 used.

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Liquidating Oil Refinery

FORMER PURE OIL COMPANY REFINERY, CHARLESTON (CABIN CREEK) W. VIRGINIA

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Roy Crisp—Manager—Charleston, West Virginia

FOR SALE
YACHT REVILO
TO SETTLE AN ESTATE

LENGTH 60' BEAM 15' DRAFT 5'0"
TWIN DIESEL ENGINES, 225 H.P. EACH
RADIO DIRECTION FINDER, SHIP TO SHORE TELEPHONE, AUTOMATIC PILOT, FATHOMETER, SHORE CHARGER
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IN EXCELLENT CONDITION

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ANOTHER BRILL LIQUIDATION!

FORMER LACY REFINERY,

BIG SANDY, TEXAS

COMPLETE POLY UNIT, BUILT 1960

1—**Wyatt 30" x 70'** Stabilizer 160# 20 tray
3—**Absorbers, 14" x 40', 20" x 50', 160#**
2—**Wash Towers, 18" x 22', 150#**
1—**Reactor, 24" x 38', 550#**
1—**Depropanizer, 30" x 35', 450#**
1—**Debutanizer, 12" x 26', 120#**
3—**Brinkman** vertical tube furnaces 2, 1¼ mil. BTU/hr.
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
3—Adm. heat exchangers 424, 346, 176 sq. ft.
2—**Perco** reactors 4500 gal., 8' x 12', 347 stls. st. 120#, 1000° F.
1—**5' x 96'** tower, 40 tray, 135# WP
1—**7' x 30'** Propane tank, 250# WP
1—**10' x 50'** Crude tower, 18 trays
1—**6' x 34'** Vacuum tower, 150#
1—**2' x 50'** tower, 24 trays
3—**Welded tanks, 10' x 40', 10' x 30', 5' x 20'**
3—St. exchs., 2000, 1500, 480 sq. ft.
9—**Oilfield** boilers, 125 hp., 275#
1—Ethyl lead plant
3—**Penn.** comp. 8 x 11 x 9, 12 x 11½ x 13, 10 x 8 x 11
2—Convection furnaces, 4-6 ch tubing
1—Vapor phase cracking furnace
30—Welded storage tanks, 5000, 2000, 1000, 500 Bbl.
1—Waukesha anti-knock machine
8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8
30—Duplex piston pumps, all sizes
1—10' x 30' asphalt still
6—Steel Bldgs., 20 x 150, 12 x 20, 20 x 40, 20 x 20.
2—Pritchard cooling towers, Adm. Bentube exchanges
1—BS&B Oil & gas separator, 10.7 mcf, 3500 Bbl./day.

COMPRESSOR STATION—BALT., MD.

3—600 hp IR KVG Gas Comp.
1—MWK 2400 sq. ft. adm. exch. 150#

FINAL LIQUIDATION, LEVELLAND, TEX.

6' x 58' ch lined tower, 50#, 21 tray
5' x 40' ch lined vessel, 90#
30,000 ft., 4, 6 in. pipe
5,000 ft. 2", 4", 4-6 ch pipe

EQUIPMENT ELSEWHERE

COLUMNS

7' x 115' 50 tray
8' x 75' 25 tray 40#
2' x 60' 35 tray 560#

HEAT EXCHANGERS

6—Adm. 785, 742, 425 sq. ft.
3—St. 2000, 785 sq. ft.
30—Atmospheric Bentube exch., stls and Adm. 715, 470 sq. ft.
30—304 SS shell & tube condensers 100-1000 sq. ft.

MISCELLANEOUS

Lab Petro-chem furnace 50,000 BTU/hr.
Gould 4" Pump 400 gpm 1600' hd
B-J hot oil pump 3 x 9, 13 st, 325 gpm, 4620' hd
Gould 16" pump 10,500 gpm, 135' hd.
Tremendous selection stainless steel and steel valves ½" - 6"

Partial List Only

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2401 Third Ave., New York 51, N. Y., CYpress 2-5703

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FOR SALE—MAYHEW 1000 Drill mounted on 1954-F-600 Ford truck; 850 gallon water tank mounted on 1954 F-600 Ford truck, 18 months old. Working on good contract. 220 feet drill pipe, hand tools, spare parts, etc. Box J-260, The Oil and Gas Journal, Tulsa, Oklahoma.

HOT OIL PUMPS
Worth. 12" KUF Diesel drive.
Nat. Tr. 4x12 HDOEP Duplex.
Worth. 9x5x10 Duplex.

TRANSFER PUMPS
Duplex from 4x3x4 to 10x7x12.

FURNACE TUBES
4-6% Chrome ½ New Cost.

TOWERS—COLUMNS
4'x59' 160 PSI 23 trays.
2'x47' 375 PSI 20 trays.
3'x49' 425 PSI 28 trays.
7'x54' 150 PSI 20 trays.
7'6"x41' 160 PSI Reactor.

FURNACES
Crude Oil 8 Million BTU.
Light Oil 10 million BTU.

HEAT EXCHANGERS
94 to 550 sq. ft. Steel Tubes.
140 to 440 sq. ft. Adm. Tubes.

COMPRESSORS
1406 SCFM Gas Driven 250 PSI.
211 CFM Motor Drive 100 PSI.

ETHYL BLENDING PLANT
4200 gal. Tank, Scale & Building.

STORAGE TANKS
500 to 20,000 bbl. All Welded.

BOILERS
153 HP 160 PSI Water Tube (3).
250 HP 150 PSI Stirling.

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310 Thompson Bldg. Tulsa 3, Okla.

ROTARY DRILLING RIGS FOR SALE

1—250 double drum Emsco triple Lee C. Moore Derrick—twin GMC 8V sub structure—27¼x14 Gardner-Denver pump, twin GMC, 5000 to 6000' of 3½" drill pipe, light plant etc. A complete drilling rig.

1—Model RL Cardwell pole mast Derrick handles doubles, 7' sub structure, 5000—3½" drill pipe, 7¼x14 Gardner-Denver pump, light plants, all tools, tanks etc. All in excellent operating condition. This rig does a nice job with 3½" drill pipe to 5000 feet.

These two rigs are clean, late models in top mechanical condition with everything needed to start drilling.

Will sell on time or take part payment in drilling to responsible firm or persons.

Lubbock Machine & Supply

North Avenue H., P. O. Drawer 1589, Lubbock, Texas

PIPE 1/8" thru 30"

FASTER THAN FOSTER

TESTED & STRUCTURAL
Large Warehouse Stocks

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FOR SALE: 86' Oilwell Mast, with 4½ Substructure. Telephone: CE 2-6318, Okla. City, Okla.

FOR SALE: Bucyrus-Erie Model 24L spudder, complete with core bbl., light plant, large and small tools for top to bottom drilling. Call or write Geo. H. Wickham, Phone 4551, Box 595, Grayville, Illinois.

FOR SALE—At our Arkansas City, Kansas Gasolene Plant, 3—4'x53'9" Tulsa Boiler Type welded absorbers, 20 trays, ⅞" flange quality plate, ASME code welded 400# WP at 120° F., with piping. Lowered, each $6500.00. Complete data upon request. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE—At Tallant, Oklahoma, three **5' x 50'** Absorbers, 20 Trays, 24" Spacing **400#** WP, peak design each 40,000 MCFD at **380** PSIG; Oil Rate 100-300 GPM, min. and **max**. Bought new 1947, taken out of service 1954. Price $8500.00 each, now standing. Full **data** upon request. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

GAS METERS: Foxboro, Emco and Westcott Orifice Meters for sale. Geo. R. Milner, Box 124, Okmulgee, Okla.

3500 FT. Wilson Rotary Rig complete. Air controlled. 3200 ft. 4½ F. H. Drill Pipe. 4 Drill Collars. 7¼x10 FXO Gardner-Denver Pump. All Butane equipped. Call #2 or #411, Cleveland, Oklahoma, RIverside 7-0658, Tulsa, Okla.

185 H.P. SUPERIOR, horizontal, twin, direct-connected engine and compressor with 8 x 16 x 20 Ingersoll-Rand compressor cylinders, in running condition, including some spare parts. Location central Oklahoma. Dorset Company, 610 National Bank of Tulsa Building. LUther 4-7769.

MAYHEW MODEL 1000 mounted on Ford F-800 1954 truck with 18 lengths drill pipe, 6" and 8" bits. Equipment one year old, excellent condition. Write Kohl Bros., 21st & Greenwood, Harrisburg, Penna.

CORE DRILLS, SPUDDERS, ROTARIES. **New** and used equipment. Everything in **supplies**. Fishing tools rented. Pressey & **Son**, Pueblo, Colo.

FOR SALE—At our Arkansas City Gasolene Plant—1—31"x61'3" Tulsa Boiler Stabilizer, 35 trays, ¾" flange quality plate shell, ASME code welded, 460# W.P. at 350° F. stress relieved, with 3'x8' Jacking Engineering reboiler, two Alco 8"x84" and 168" heat exchanges, lowered, lot price $5000.00. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

WILSON MOGUL Double Drum Unit with Waukesha 145 GKU, 87' Double Leg Mast Pole, 6' High 30' Long Substructure, 12" Brewster Rotary, 5"x10" Mud Pump with Waukesha Engine, Tool House, Kelly, Generating Set, Water Tank, Shale Separator, Hand Tools, 3 Years Old. Stored at Odessa. $25,000.00. Norvell-Wilder Supply Co. Phone CA 8-3471 or P. O. Box 2178, Houston, Texas.

HELP WANTED

SEISMOGRAPH Computer. Must be experienced and free to travel. Box J-234, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

Petroleum Engineer between 28 and 35 years of age with field experience and interest in reserves and valuation work. New York financial institution offers opportunity for experience and advancement. Please send resume of personal history, experience, and recent photograph. Replies will be considered as being strictly confidential. Write P. O. Box 226, Church Street Station, New York 8, N. Y. Dept. 12.

HELP WANTED

WANTED: SEISMIC PARTY CHIEF for central computing office. Must be experienced interpreter and have degree in geophysics or geology. Also need experienced computer for central office and computer draftsman for home office. Write giving education and experience to Box J-262, The Oil and Gas Journal, Tulsa, Oklahoma.

PROFESSOR OF Petroleum Engineering to be responsible for undergraduate curriculum and graduate courses. M.S. or Ph.D. Interest in research desired and full cooperation of University assured. Rank and salary dependent upon education and experience. University of Illinois, Urbana, Ill. Mining & Metallurgical Dept.

AGGRESSIVE medium size rock bit company needs experienced man for field sales work leading toward sales manager position. Considerable travel involved at first with attractive remuneration. Send snapshot with all pertinent information. Gruner & Company, Inc. P. O. Drawer 911, Ponca City, Oklahoma.

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Mapping Draftsman, preferably with some geological drafting background. Salary open. Reply

Reynolds Mining Corp.
OIL AND GAS DIVISION,
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A large crude oil pipe line company, operating within Oklahoma, has openings for Engineering graduates. Diversified, interesting and permanent employment with advancement opportunities. Experience not essential, but a reasonable knowledge of hydraulics, office and field work in the design of crude oil pipe lines and pump stations is desirable. Submit resume and salary requirements including a recent snapshot to—

Box J-249,
The Oil and Gas Journal,
Tulsa, Oklahoma.

DRILLING EQUIPMENT ENGINEER

Foreign Service

With degree in Petroleum or Mechanical Engineering, plus minimum of 5 years' experience in the design, manufacture, use and maintenance of drilling equipment and supplies. A knowledge of the various drilling equipment manufacturers and their products necessary. Salary dependent upon experience and qualifications.

Write giving full particulars regarding personal history and work experience. Please include your telephone number.

Recruiting Supervisor, Box 74

ARABIAN AMERICAN OIL COMPANY
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HELP WANTED

DRILLING SUPERINTENDENT with engineering or technical background, for employment in Italy. Must read and write Italian. Box J-263, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—PRODUCTION ENGINEER. For job with consultant in Cuba. Completion experience essential. Send photo, complete personal record, and salary expected. Box J-264, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT oil and gas company desires to hire petroleum engineer to supervise production and well completion of gas and oil properties in East Texas, Louisiana. Immediate opening. All replies confidential. Box J-228, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED.—Lease Records Man with minmum two years experience, to be located in New Orleans, Louisiana with prominent company. Box J-255, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 4 or 5 years experience with emphasis on valuation and Reservoir Engineering. Must be free to travel with Dallas as headquarters. Initial letter application should set out past experience in detail, education and salary requirements. Box J-259, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

GRADUATE PETROLEUM ENGINEER—Oil company has opening at Midland, Texas, for aggressive field production engineer, under 38 years of age, with minimum of two years' West Texas experience plus proven ability in testing, drill stems, workovers and completions. P. O. Box 3053, Dallas, Texas.

CHIEF CHEMIST—For research and plant control. New plant being built in Houston area, manufacturing all grades industrial and paving grade asphalts. Submit resume of experience along with availability and expected salary to Box J-279, The Oil and Gas Journal, Tulsa, Oklahoma.

ESTIMATORS

Experienced in Process Equipment and piping costs, for Chemical Plant & refinery construction. Position offers good future with progressive Penna. firm. Send resume to

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MECHANICAL ENGINEERS

Employment Opportunities in SOUTH AMERICA

Attractive staff positions available with affiliates of STANARD OIL COMPANY (N. J.)

Must be thoroughly qualified and experienced in design and/or maintenance of refinery or chemical plant equipment including piping, pressure vessels, heat exchangers.

Attractive salary, liberal annuity and savings program offered.

Write, giving age, marital status, education and details of previous experience.

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REFINERY SUPERINTENDENT—For independent refinery in Houston, Texas area. Applicant must have heavy experience in processing heavy crude. Plant will be manufacturing all grades of industrial and paving asphalts. Salary open. Submit resume of experience along with availability and expected salary to Box J-278, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANTED BY OIL COMPANY

Material Control Clerk with oil and gas experience. At least high school education, salary range between $350 and $400 depending on qualifications. Reply

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Opening December 15 with active independent for geologist with 2 to 3 years experience in Oklahoma. Reply should include full details of qualifications, education, and past employment.

Box J-272,
THE OIL AND GAS JOURNAL,
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FOR ECONOMICAL FILING of full-size electric logs, most geologists prefer Kraftbilt E-24, 4-drawer cabinet. Two compartments to each drawer with separate follow blocks make this cabinet handy, economical. For filing reduced electric logs, geologists use Kraftbilt E-28 8-drawer cabinet. Send for new Catalog 1054-B. Rose-Martin Co., P. O. Box 800-A, Tulsa 1, Oklahoma.

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Box J-269, The Oil and Gas Journal,
Tulsa, Oklahoma

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

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FOR SALE: patent right for Kentucky, highly successful chemical, widely used by oil and gas producers. Proven valuable for secondary recovery. Box J-276, The Oil and Gas Journal, Tulsa, Oklahoma.

GET SHALLOW production with bigger profits on it; I have the structures for such; you can get them. N. M. Sauls, Geologist, Cookeville, Tenn.

GOLD-SILVER-COPPER romance is really thrilling if you have sporting money; plus a chance to win. YORK MINES, Box 1135, ALBUQUERQUE, N. M.

A PROPOSITION—A Landman, two Geologists, and one Senior Geophysicist, each with over three years' experience plus college degrees or graduate work, desire financial investments for Oil Exploration in West Texas and New Mexico. Will form small company under three year contract, yearly option basis. Faithful performance bond will be posted equal to investors' shares. Complete Geological, Geophysical, and Land information is available. Write Box J-268, The Oil and Gas Journal, Tulsa, Oklahoma.

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PHILIP L. POE, V. P.,
210 E. Redwood St.,
Baltimore 2, Md.

Successful Wildcats

(Continued from page 196)

1¼ miles southeast of production in NE NE SE 13-28n-8w. IPF 14 BDPD, basal Penn. 4,821-31 ft., 10,000 M.c.f. of gas per day, 26/64-in. choke, 59°. TD 4,962 ft. (Gas-distillate discovery).

Texas County: Panhandle Eastern Pipeline Co. 2-18 Enns, C NE SW 18-3n-18eCM. IPF 67,500 M.c.f. of gas per day, Morrow sand 6,230-72 ft. TD 6,645 ft. (Gas discovery).

SASKATCHEWAN

McCarty & Coleman 6-26 Knight, LSD 6, 26-7-34w1. Mission Canyon well. TD 3,986 ft.

NORTH TEXAS

Archer County: L. T. Burns estate 1-E Cowan & McKinney, Sec. 46, Jefferson CSL Sur., 6½ mi. SE Archer City. IP 124 bbl. oil in 6 hr., 12/64-in., calculated potential 496.2 BOPD, TP 835 psi., 43°, GOR 650, Mississippian 5,240-58 ft. TD 5,261 ft.

Clay County: Bridwell Oil Co. 1 Rudolph, Blk. 4, Patrick Gilliland Sur., A-162, 8 mi. WNW Shannon. IPP 43 BOPD, 40°, GOR 320, pay 3,314 ft. TD 5,434 ft.

M. O. Rife, Jr. and Ben Hogan 1 Windle, Blk. 58, J. H. Belcher Subd., 7 mi. NW Joy. IP 240 BOPD, 16/64-in., TP 80 psi., 41.5°, GOR 500, Strawn 4,470-76 ft. TD 4,540 ft.

Grayson County: H. S. Moss 1 City of Sherman, drilling Blk. 4, I Clark, J. B. McAnair Sur., A-763, 1½ mi. N Sherman. IP 193 BOPD, 17/64-in., TP 150 psi., 36°, Davis sand 8,152-74 ft. TD 10,809 ft.

Jack County: Warren Petroleum Corp. 1 Worthington, J. Y. Collier Sur., A-136, 5 mi. NE Jacksboro. IP 34 BOPD, 48/64-in., TP 940-40 psi., 44°, GOR 11,494:1, conglomerate pay 5,338-50 ft. TD 5,523 ft.

Wise County: Greenbrier Oil Co. 1 Glass, Sec. 3, Cooke CSL, A-156, Blk. 11, 4 mi. NW Alvord. IPP 41 BOPD, 38°, GOR 100, Strawn 4,239-45 ft. TD 4,891 ft.

SOUTHWEST TEXAS

Atascosa County: Continental Oil Co. 1 Sutton, Marcellino de la Garza Sur., A-321. IPP 70.92 BOPD, net, 15.5 per cent water, 36°, open hole 7,164-76 ft. (Buda lime). TD 7,476 ft. (New field.)

Dimmit County: Sutton Drilling Co. 1 McComb, H&GN Sur., A-129. IP 16 BOPD, 9/64-in., 40°, perforations 3,322-30 ft. (Olmos 2 sand). TD 3,582 ft. (New field.)

TEXAS GULF COAST

Bee County: Arnold H. Bruner & Co. 2 Roundtree, H&GN Sur., A-192. IP 1,000 M.c.f. daily, open-flow potential, dry gas, perforations 3,442-47 ft. (Frio). TD 4,500 ft. (New pay in Sliva field.)

Fort Bend County: Humble Oil & Refining Co. 48-A Lockwood & Sharp, John Rabb Sur., A-73. Potential gas well, standing with casing cemented, not tested. TD 9,027 ft. (Extends Thompson field—7-in. at 8,218 ft.)

Harris County: A. L. Selig 1-A Hilda Fisher, Thomas Hogan Sur., A-326. IP 86 BOPD, 5/32-in., 39.8°, perforations 7,227-30 ft. TD 7,682 ft. (New pay in East Satsuma field.)

Jackson County: Kelly Oil Co. 1 Fenner, I&GN Sur., A-178. IP 2,010 M.c.f. daily, open-flow potential, dry gas, perforations 2,726-28 ft. (Catahoula). TD 4,800 ft. (New pay and extension in North Rorales field.)

Aluminum Corp. of America and Crown Central Petroleum Corp. 1 State, Tract 261, Carancahua Bay. IP 235.48 BOPD, 5/32-in., 40°, perforations 7,848-52 ft. (Frio "B" sand). TD 9,000 ft. (New pay and extension in Appling field.)

TEXAS PANHANDLE

Ochiltree County: Union Oil Co. 1 Buckhaults, Sec. 32, Blk. JTM, BS&F Sur. IP 321 BOPD, 38°, 38-in. choke, Morrow 7,966-90 ft. TD 8,060 ft.

WEST CENTRAL TEXAS

Fisher County: General Crude Oil Co. 8 Edwin Aiken, 249-3-H&TC, new pay in Bernecker field. IPP 87 BOPD, 42°, GOR 217, Ellenburger 7,040-50 ft. TD 7,062 ft.

Haskell County: Phillips Petroleum Co. 1-A Hoil, Red River CSL Sur. 74, A-348, Subd. 22, 5 mi. NE Rule. IP 115 BOPD, 22/64-in., TP 60 psi., 42°, GOR 499, Caddo 5,536-46 ft. TD 6,081 ft.

Nolan County: C. L. Norsworthy, Jr. Wm. Wight heirs, 94-22-T&P, 7 mi. S Sweetwater. IP 150 BOPD, 16/64-in., TP 175 psi., 40°, Ellenburger 6,838-74 ft. TD 6,937 ft.

Shackelford County: A. V. Jones 1 Damewood, 90-13-T&P, 8 mi. NW Clyde. IP 121 BOPD, 34-in., TP 420 psi., 45°, GOR 41,083:1, pay 3,446 ft. TD 3,506 ft.

Stephens County: H. R. Britton 2 McDonald, John Roach Sur., A-1057, 3¼ mi. S Eliasville, new pay. IP 168.5 BOPD, 24/64-in., TP 400 psi., 40°, GOR 800, conglomerate 3,982-88 ft. TD 4,500 ft.

Taylor County: Herring Drilling Co. and Southern Minerals Corp. 1 Alexander, H. Plummer Sur. 530, Subd. 35, 4 mi. W Ovalo. TP 84 BOPD, 16/64-in., TP 120 psi., 42.8°, GOR 420, Cross Cut 3,997-4,009 ft. TD 4,810 ft.

WEST TEXAS

Andrews County: Plateau Oil Co. 3 Thornberry, 2-A42-PSL, 8 mi. W Andrews, Grayburg discovery in Fuhrman-Mascho area. IP 164 BOPD, 10/64-in., CP 310 psi., GOR 586, 33°, pay 4,204-4,306 ft. TD 4,471 ft.

WEST VIRGINIA

Randolph County, Dry Fork district: Columbian Carbon Co. 1-1208 D. Hill Arnold, elevation 3,155 ft. (deepened from 4,846 ft.), 9,832,000 cu. ft. gas, 4,962-5,000 ft. TD 5,008 ft.

Guidebook Available

The guidebook from the eighteenth field conference of the Kansas Geological Society is available from the society's offices at 508 East Murdock, Wichita, Kans.

LEGAL

NOTICE: Office of District Director of Internal Revenue, Oklahoma City, Okla. The following described real property, seized from Wilbur Howard McCormack, alias M. L. McCormack d/b/a Indian Head Oil Co., 2723 N. W. 32nd, Oklahoma City, Oklahoma, by distraint for the non-payment of assessed taxes due, will be sold as provided for in Section 6331 of the Internal Revenue Code of 1954, at public auction on Thursday, December 29, 1955, at 11:00 A.M., at the Court House steps in Wewoka, Oklahoma: 15.64 of ⅞ Interest in the Bowlegs Lease covering the Northeast Quarter ($NE^1/_4$) of the Northwest Quarter ($NW^1/_4$) of Section Thirty-one (31) Township Eight (8) North, Range Eight (8) East, Seminole County, Oklahoma; and Twenty Five Percent Interest in the Payne Lease covering the Northeast Quarter ($NE^1/_4$) of the Northwest Quarter ($NW^1/_4$) of Section Twenty (20), Township Six (6) North, Range Seven (7) East, Seminole County, Oklahoma. Earl R. Wiseman, District Director.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 520 acres within the known geologic structure of Wilson Creek Field, Rio Blanco County, Colorado, in one parcel, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., December 27, 1955, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

LEGAL

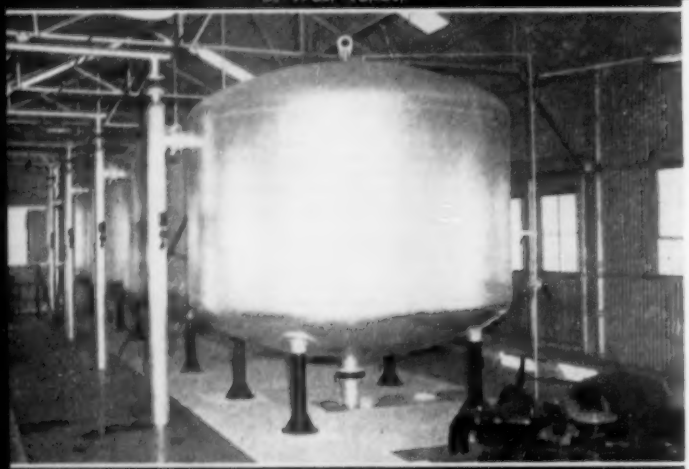
U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that approximately 680 acres of land in four parcels, within the known geologic structure of Williams Park Anticline, Routt County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., December 28, 1955, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. George H. Woodhall, Manager.

LEGAL

Sealed bids will be received until December 14, 2:00 P. M. Mountain Standard Time, and opened at that time in the office of the Superintendent, Fort Belknap Consolidated Agency, Harlem, Montana, for the leasing of 1,288.34 acres of Tribal land and 19,003.96 acres of allotted Indian land located in Township 28 North, and Ranges 24 and 25 East, Principal Meridian, Montana, County of Blaine, Montana for oil and gas mining purposes. For further detailed information and a list of lands advertised call or write: Darrell Fleming, Superintendent, Fort Belknap Consolidated Agency, Harlem, Montana. Telephone 5R-1.

NATIONAL RAPID MECHANICAL WATER FILTERS

Four 8' x 5' National Rapid Mechanical Water Filters in West Texas.



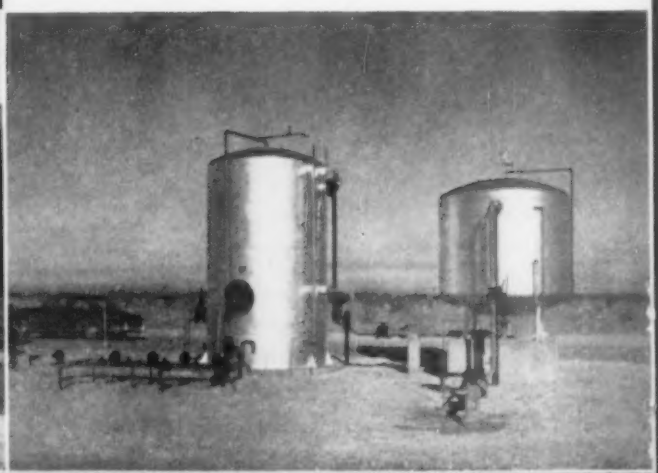
Four 10' x 5' National Rapid Mechanical Water Filters on an Oklahoma water flood project.

National Rapid Mechanical Water Filters are used for filtering water in salt water disposal and water flood projects and municipality installations. Filters are rated according to best empirical values. Common backwash rates are 12 to 20 gallons per minute, per sq. ft. of filter area.

Size	Nominal Water Cap. Bbl./Day	Approxmiate Weight of 40 lb. W.P.
4' x 5'	1060	1400 lb.
6' x 5'	2300	2100 lb.
7' x 5'	3200	2400 lb.
8' x 5'	4200	3200 lb.
10' x 5'	6600	5540 lb.

NOTE: Filters are furnished in 40, 75 and 100 PSI W.P.

A National 4' x 5' Rapid Mechanical Water Filter in a water disposal plant in Texas.



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TULSA, OKLAHOMA

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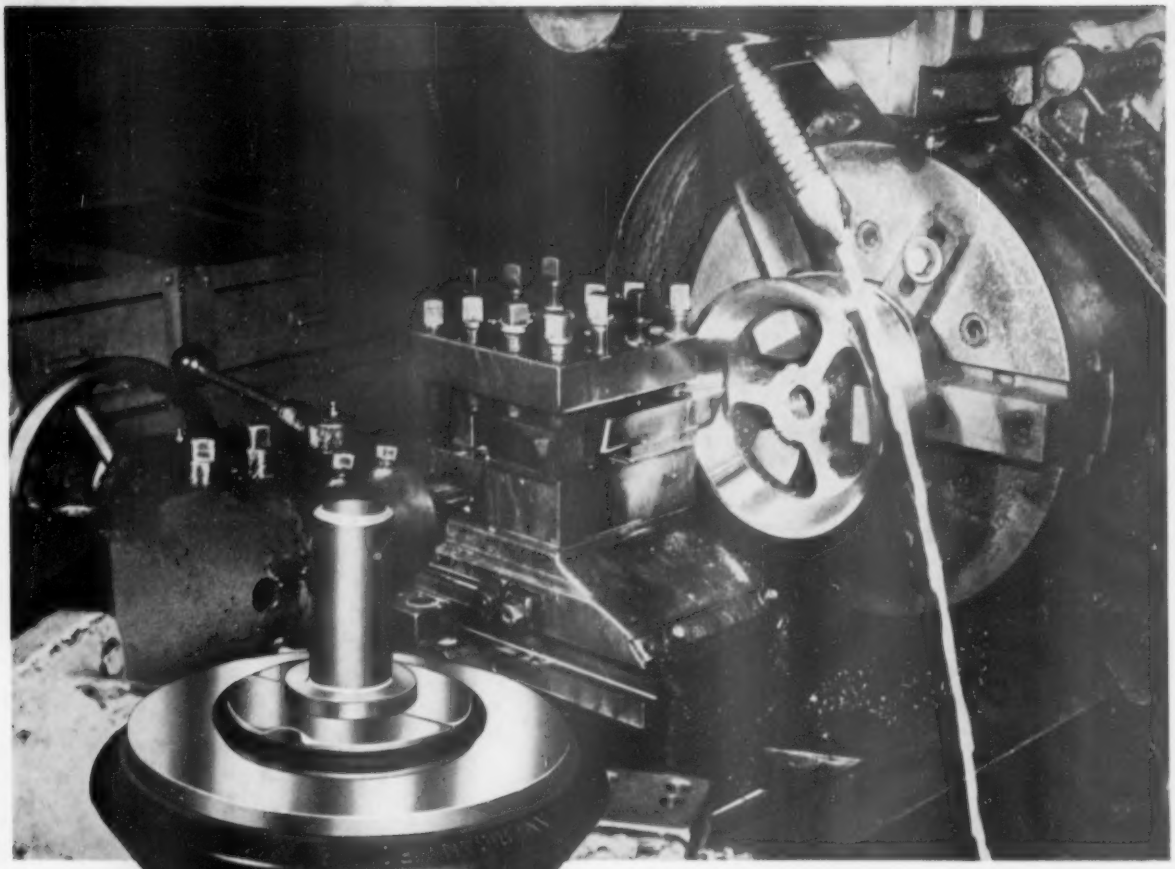

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